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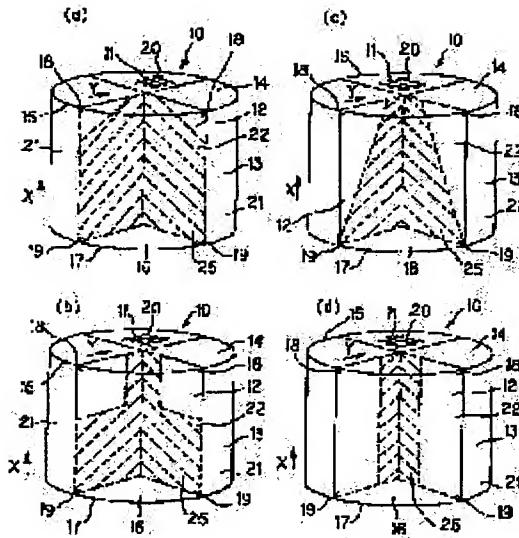
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(54) HONEYCOMB CONSTRUCTION BODY, HONEYCOMB FILTER AND THEIR  
MANUFACTURING METHOD

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a honeycomb construction body which is excellent in durability and does not cause the occurrence of crack due to thermal stress in using, and their manufacturing method.

SOLUTION: The honeycomb structure body is provided with a plurality of honeycomb members 21 having many ventilation holes 11 partitioned by partitions 20. These honeycomb members 21 are joined by surfaces (joining surfaces) 22 being substantially parallel to the passage direction of the ventilation holes to be integrated to form the honeycomb structure body. The surface 22 at the member 21 includes an end part to be connected with a passage entrance end face outer peripheral part 15 and/or a passage exit end face outer peripheral part 17 and has an unjoined part 12 in the structure.



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## CLAIMS

[Claim(s)]

[Claim 1] Two or more preparations and these two or more honeycomb members substantially the honeycomb member which has the circulation hole of a large number divided by the septum with this honeycomb member by the joint material of this quality of the material It is the honeycomb structure object with which it is substantially joined to the direction of passage of this circulation hole in respect of being parallel, and comes to unify these two or more honeycomb members. The honeycomb structure object with which the plane of composition in this honeycomb member is characterized by having the unsealed section at least including the edge linked to the passage inlet-port end-face periphery section and/or the passage outlet end-face periphery section.

[Claim 2] It has two or more honeycomb members which have the circulation hole of a large number divided by the septum. It is the honeycomb structure object which joins these two or more honeycomb members to the direction of passage of this circulation hole by joint material in respect of being parallel

substantially, and it comes to unify. Si content as which this honeycomb member uses Metals Si and SiC as a principal component, and is specified by  $\text{Si}/(\text{Si}+\text{SiC})$  is 5 - 50 % of the weight. Si content as which this joint material uses Metals Si and SiC as a principal component, and is specified by  $\text{Si}/(\text{Si}+\text{SiC})$  The honeycomb structure object with which equivalent [ to this honeycomb member joined ], and it is 10 - 80 % of the weight than it, and the plane of composition in this honeycomb member is characterized by having the unsealed section at least including the edge linked to the passage inlet-port end-face periphery section and/or the passage outlet end-face periphery section.

[Claim 3] The honeycomb structure object according to claim 1 or 2 with which this joint material is characterized by being continuously arranged in this plane of composition.

[Claim 4] A honeycomb structure object given in any 1 term of claims 1-3 characterized by preparing this unsealed section of this plane of composition in the direction of passage of this circulation hole by 10% or more of die length to the overall length of this honeycomb structure object in this direction from this passage inlet-port end-face periphery section or the passage outlet end-face periphery section.

[Claim 5] A honeycomb structure object given in any 1 term of claims 1-4 characterized by preparing this unsealed section of this plane of composition in the direction of a core of each end face by 10% or more of die length to full [ of this honeycomb structure object in this direction ] from this passage inlet-port end-face periphery section or this passage outlet end-face periphery section.

[Claim 6] A honeycomb structure object given in any 1 term of claims 1-5 characterized by arranging in this a part of unsealed section [ at least ] of this plane of composition the restoration member which uses a heat-resistant inorganic material as a principal component.

[Claim 7] The honeycomb structure object according to claim 6 with which material strength of that the Young's modulus of this restoration member is 80% or less of the Young's modulus of a honeycomb member or this restoration member is characterized by the thing of thing \*\* smaller than the material strength of this honeycomb member for which either is satisfied at least.

[Claim 8] At least one sort of ceramics chosen from the group which the principal component of this honeycomb member becomes from cordierite, a mullite, an alumina, a spinel, silicon carbide, silicon nitride, lithium aluminium silicate, aluminum titanates, and such combination, or a honeycomb structure object given in any 1 term of claims 1, 3-7 which are Fe-Cr-aluminum system metals.

[Claim 9] A honeycomb structure object given in any 1 term of claims 1-8 characterized by supporting the catalyst on the septum of this honeycomb member.

[Claim 10] The circulation hole of a large number which it is divided by the septum and penetrated to a passage inlet-port end face and a passage outlet end face It has two or more \*\*\*\* suggestion \*\*\*\*\* honeycomb filter members alternately by this passage inlet-port end face and passage outlet end face which this circulation hole penetrates. This honeycomb filter member in respect of being parallel to the direction of passage of this circulation hole It joins to this honeycomb filter member by the joint material of this quality of the material substantially. The honeycomb filter with which it is the honeycomb filter which it comes to unify, and the plane of composition in this honeycomb filter member is characterized by having the unsealed section at least including the edge linked to the passage inlet-port end-face periphery section or the passage outlet end-face periphery section.

[Claim 11] The circulation hole of a large number which it is divided by the septum and penetrated to a passage inlet-port end face and a passage outlet end face It has two or more \*\*\*\* suggestion \*\*\*\*\* honeycomb filter members alternately by this passage inlet-port end face and passage outlet end face which this circulation hole penetrates. These two or more honeycomb filter members in respect of being parallel to the direction of passage of this circulation hole It is the honeycomb filter which it joins and comes to unify by joint material. The base of this honeycomb filter member uses Metals Si and SiC as a principal component. Si content specified by  $\text{Si}/(\text{Si}+\text{SiC})$  is 5 - 50 % of the weight. Si content as which this joint material uses Metals Si and SiC as a principal component, and is specified by  $\text{Si}/(\text{Si}+\text{SiC})$  More [ equivalent / to the base of this honeycomb filter member joined / or / it ] And the honeycomb filter with which it is 10 - 80 % of the weight, and the plane of composition in this honeycomb filter member is characterized by having the unsealed section at least including the edge linked to the passage inlet-port end-face periphery section and/or the passage outlet end-face periphery section.

[Claim 12] The honeycomb filter according to claim 10 or 11 with which this joint material is characterized by being continuously arranged in this plane of composition.

[Claim 13] A honeycomb filter given in any 1 term of claims 10-12 characterized by preparing this

unsealed section of this plane of composition in the direction of passage of this circulation hole by 10% or more of die length to the overall length of this honeycomb filter in this direction from this passage inlet-port end-face periphery section or this passage outlet end-face periphery section.

[Claim 14] A honeycomb filter given in any 1 term of claims 10-13 characterized by preparing this unsealed section of this plane of composition in the direction of a core of each end face by 10% or more of die length to full [ of this honeycomb filter in this direction ] from this passage inlet-port end-face periphery section or this passage outlet end-face periphery section.

[Claim 15] A honeycomb filter given in any 1 term of claims 10-14 characterized by arranging in this a part of unsealed section [ at least ] of this plane of composition the restoration member which uses a heat-resistant inorganic material as a principal component.

[Claim 16] The honeycomb filter according to claim 15 with which material strength of that the Young's modulus of this restoration member is 80% or less of the Young's modulus of a honeycomb member or this restoration member is characterized by the thing of thing \*\* smaller than the material strength of this honeycomb member for which either is satisfied at least.

[Claim 17] A honeycomb filter given in any 1 term of claims 10, 12-16 which are at least one sort of ceramics chosen from the group which the principal component of this honeycomb filter member becomes from cordierite, a mullite, an alumina, a spinel, silicon carbide, silicon nitride, lithium aluminium silicate, aluminum titanates, and such combination, or a Fe-Cr-aluminum system metal.

[Claim 18] A honeycomb filter given in any 1 term of claims 10-17 characterized by supporting the catalyst on the septum of this honeycomb member.

[Claim 19] Raw material powder, a binder, and water are kneaded, and the obtained kneading object is fabricated, it dries, and a honeycomb object is acquired. Subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in this honeycomb object at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as this honeycomb object. Subsequently The manufacture approach of the honeycomb structure object characterized by calcinating after joining these two or more honeycomb objects through this junctional zone and unifying.

[Claim 20] After kneading, fabricating the obtained kneading object, drying and using raw material powder, a binder, and water as a honeycomb object, further, this honeycomb object is calcinated and a honeycomb member is obtained. Subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in this honeycomb member at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as this honeycomb object. Subsequently The manufacture approach of the honeycomb structure object characterized by calcinating after joining these two or more honeycomb members through this junctional zone and unifying.

[Claim 21] After kneading, fabricating the obtained kneading object, drying and using raw material powder, a binder, and water as a honeycomb object, the appearance of this honeycomb object is processed further. Subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in this honeycomb object at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as this honeycomb object. Subsequently The manufacture approach of the honeycomb structure object characterized by calcinating after joining these two or more honeycomb objects through this junctional zone and unifying.

[Claim 22] Raw material powder, a binder, and water are kneaded, and the obtained kneading object is fabricated, it dries, and a honeycomb object is acquired. Subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in this honeycomb object at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as this honeycomb object. Subsequently The manufacture approach of the honeycomb structure object characterized by processing an appearance after joining these two or more honeycomb objects through this junctional zone and unifying, and calcinating after that.

[Claim 23] Further, after kneading, fabricating the obtained kneading object, drying and using raw

material powder, a binder, and water as a honeycomb object, it calcinates and a honeycomb member is obtained, after processing the appearance of this honeycomb object. Subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in this honeycomb member at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as this honeycomb object. Subsequently The manufacture approach of the honeycomb structure object characterized by calcinating after joining these two or more honeycomb members through this junctional zone and unifying.

[Claim 24] Raw material powder, a binder, and water are kneaded, and the obtained kneading object is fabricated, and it dries, and considers as a honeycomb object. Subsequently After calcinating this honeycomb object and considering as a honeycomb member, the appearance of this honeycomb member is processed. Subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in this honeycomb member at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as this honeycomb object. Subsequently The manufacture approach of the honeycomb structure object characterized by calcinating after joining these two or more honeycomb members through this junctional zone and unifying.

[Claim 25] The manufacture approach of a honeycomb structure object given in any 1 term of claims 19-24 characterized by forming this junctional zone continuously.

[Claim 26] The manufacture approach of the honeycomb structure object characterized by processing further the appearance of the honeycomb structure object acquired by the approach given in any 1 term of claims 19-25.

[Claim 27] The manufacture approach of the honeycomb structure object characterized by applying the filler which uses a heat-resistant inorganic material as a principal component to a part of side face [ at least ] of the honeycomb structure object acquired by the manufacture approach given in any 1 term of claims 19-26.

[Claim 28] The manufacture approach of a honeycomb structure object given in any 1 term of claims 19-27 characterized by arranging the filler which uses a heat-resistant inorganic material as a principal component in a part of part [ at least ] in which the junctional zone is not formed among the fields which formed this junctional zone in the part.

[Claim 29] The manufacture approach of a honeycomb structure object given in any 1 term of claims 19-28 characterized by the principal component of this honeycomb object and this junctional zone consisting of at least one sort of ceramics chosen from the group which consists of cordierite, a mullite, an alumina, a spinel, silicon carbide, silicon nitride, lithium aluminium silicate, aluminum titanates, and such combination, a Fe-Cr-aluminum system metal, or metals Si and SiC.

[Claim 30] The manufacture approach of the honeycomb structure object with a catalyst characterized by supporting a catalyst after manufacturing a honeycomb structure object by the manufacture approach of a publication in any 1 term of claims 19-29.

[Claim 31] Raw material powder, a binder, and water are kneaded, and the obtained kneading object is fabricated, it dries, and a honeycomb object is acquired. Subsequently The circulation hole of a large number penetrated to the passage inlet-port end face and passage outlet end face of this honeycomb object is alternately \*\*\*\*\* (ed) by this passage inlet-port end face and this passage outlet end face, and a \*\*\*\*\* honeycomb object is produced. Subsequently Substantially the junctional zone which serves as this honeycomb object from this quality of the material substantially with the direction of passage of this circulation hole in this \*\*\*\*\* honeycomb object to an parallel field The manufacture approach of the honeycomb filter which forms in a part except for the edge which connects with the passage inlet-port end-face periphery section or the passage outlet end-face periphery section at least, and is subsequently characterized by calcinating after joining these two or more \*\*\*\*\* honeycomb objects through this junctional zone and unifying.

[Claim 32] After kneading, fabricating the obtained kneading object, drying and using raw material powder, a binder, and water as a honeycomb object, further, this honeycomb object is calcinated and a honeycomb member is obtained. Subsequently The circulation hole of a large number penetrated to the passage inlet-port end face and passage outlet end face of this honeycomb member is alternately \*\*\*\*\* (ed) by this passage inlet-port end face and this passage outlet end face, and a honeycomb filter

member is produced. Subsequently Substantially the junctional zone which serves as this honeycomb object from this quality of the material substantially with the direction of passage of this circulation hole in this honeycomb filter member to an parallel field The manufacture approach of the honeycomb filter which forms in a part except for the edge which connects with the passage inlet-port end-face periphery section or the passage outlet end-face periphery section at least, and is subsequently characterized by calcinating after joining these two or more honeycomb filter members through this junctional zone and unifying.

[Claim 33] Raw material powder, a binder, and water are kneaded, and the obtained kneading object is fabricated, it dries, and a honeycomb object is acquired. Subsequently The circulation hole of a large number penetrated to the passage inlet-port end face and passage outlet end face of this honeycomb object is alternately \*\*\*\*\* (ed) by this passage inlet-port end face and this passage outlet end face, and a \*\*\*\*\* honeycomb object is produced. Subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of this circulation hole in this \*\*\*\*\* honeycomb object at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as this honeycomb object. Subsequently The manufacture approach of the honeycomb filter characterized by processing an appearance after joining these two or more \*\*\*\*\* honeycomb objects through this junctional zone and unifying, and calcinating after that.

[Claim 34] After kneading, fabricating the obtained kneading object, drying and using raw material powder, a binder, and water as a honeycomb object, the appearance of this honeycomb object is processed further. Subsequently The circulation hole of a large number penetrated to the passage inlet-port end face and passage outlet end face of this honeycomb object is alternately \*\*\*\*\* (ed) by this passage inlet-port end face and this passage outlet end face, and a \*\*\*\*\* honeycomb object is produced. Subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of this circulation hole in this \*\*\*\*\* honeycomb object at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as this honeycomb object. Subsequently The manufacture approach of the honeycomb filter characterized by calcinating after joining these two or more \*\*\*\*\* honeycomb objects through this junctional zone and unifying.

[Claim 35] Further, after kneading, fabricating the obtained kneading object, drying and using raw material powder, a binder, and water as a honeycomb object, it calcinates and a honeycomb member is obtained, after processing the appearance of this honeycomb object. Subsequently The circulation hole of a large number penetrated to the passage inlet-port end face and passage outlet end face of this honeycomb member is alternately \*\*\*\*\* (ed) by this passage inlet-port end face and this passage outlet end face, and a honeycomb filter member is produced. Subsequently Substantially the junctional zone of this quality of the material with the direction of passage of the circulation hole in this honeycomb filter member as substantially as this honeycomb object to an parallel field The manufacture approach of the honeycomb filter which forms in a part except for the edge which connects with the passage inlet-port end-face periphery section or the passage outlet end-face periphery section at least, and is subsequently characterized by calcinating after joining these two or more honeycomb filter members through this junctional zone and unifying.

[Claim 36] Raw material powder, a binder, and water are kneaded, and the obtained kneading object is fabricated, and it dries, and considers as a honeycomb object. Subsequently After calcinating this honeycomb object and considering as a honeycomb member, the appearance of this honeycomb member is processed. Subsequently The circulation hole of a large number penetrated to the passage inlet-port end face and passage outlet end face of this honeycomb member is alternately \*\*\*\*\* (ed) by this passage inlet-port end face and this passage outlet end face, and a honeycomb filter member is produced. Subsequently Substantially the junctional zone of this quality of the material with the direction of passage of the circulation hole in this honeycomb filter member as substantially as this honeycomb object to an parallel field The manufacture approach of the honeycomb filter which forms in a part except for the edge which connects with the passage inlet-port end-face periphery section or the passage outlet end-face periphery section at least, and is subsequently characterized by calcinating after joining these two or more honeycomb filter members through this junctional zone and unifying.

[Claim 37] The manufacture approach of a honeycomb filter given in any 1 term of claims 31-36

characterized by forming this junctional zone continuously.

[Claim 38] The manufacture approach of the honeycomb filter characterized by processing further the appearance of the honeycomb filter obtained by the approach given in any 1 term of claims 31-37.

[Claim 39] The manufacture approach of the honeycomb filter characterized by applying the filler which uses a heat-resistant inorganic material as a principal component to a part of side face [ at least ] of the honeycomb filter obtained by the manufacture approach given in any 1 term of claims 31-38.

[Claim 40] The manufacture approach of a honeycomb filter given in any 1 term of claims 31-39 characterized by arranging the filler which uses a heat-resistant inorganic material as a principal component in a part of part [ at least ] in which the junctional zone is not formed among the fields which formed this junctional zone in the part.

[Claim 41] The manufacture approach of a honeycomb filter given in any 1 term of claims 31-40 characterized by the principal component of this honeycomb object and this jointing material for corrugated fibreboard consisting of at least one sort of ceramics chosen from the group which consists of cordierite, a mullite, an alumina, a spinel, silicon carbide, silicon nitride, lithium aluminium silicate, aluminum titanates, and such combination, a Fe-Cr-aluminum system metal, or metals Si and SiC.

[Claim 42] The manufacture approach of the honeycomb filter with a catalyst characterized by supporting a catalyst after manufacturing a honeycomb filter by the manufacture approach of a publication in any 1 term of claims 31-41.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the honeycomb structure objects for catalyst support and honeycomb filters which are used for the exhaust gas purge of burners, such as heat engines, such as an internal combustion engine, or a boiler, the reformer of liquid fuel or gaseous fuel, etc., and those manufacture approaches.

[0002]

[Description of the Prior Art] Conventionally, the honeycomb structure object which supported the catalyst component is used for the exhaust gas purge of burners, such as heat engines, such as an internal combustion engine, or a boiler, the reformer of liquid fuel or gaseous fuel, etc. Moreover, in order to carry out uptake removal of the particulate matter contained in dust-containing fluid like the exhaust gas discharged from a diesel power plant, using a honeycomb filter is known.

[0003] It was exposed to a temperature change with rapid exhaust gas, or local generation of heat, and was easy to produce uneven temperature distribution inside, and the honeycomb structure object or honeycomb filter used for such the purpose had the problem of a crack occurring owing to it. When used as a honeycomb filter which carries out the collection of the particulate matter under exhaust air of a diesel power plant especially, it was required to burn the collected carbon particle and to remove, and since local elevated-temperature-ization was not avoided in this case, it is easy to generate big thermal stress, and was easy to generate a crack. Here, generating of thermal stress is because each part of each other is restrained by the ununiformity of temperature distribution and cannot deform freely with it to thermal-expansion deformation of each part of a honeycomb structure object differing.

[0004] Moreover, when a honeycomb structure object is enlarged by the purpose of use, creating the honeycomb structure object or honeycomb filter which joined two or more honeycomb members by joint material, and was unified is known, and the device which reduces the thermal stress generated also in this case is needed.

[0005] As a policy which reduces thermal stress, the manufacture approach of the honeycomb structure object which joins many honeycomb members to the conventional No. 4335783, for example, USP, official report by discontinuous joint material is indicated. However, since it was not taken into consideration that thermal stress occurs with this honeycomb structure object near the both-ends side periphery section which a circulation hole mainly penetrates, it was not what not necessarily eases thermal stress fully. Moreover, since joint material was prepared in discontinuity, the bonding strength of



a honeycomb member was not enough and the mechanical strength of the honeycomb structure object acquired was not necessarily enough.

[0006] Moreover, after carrying out extrusion molding of the matrix member of the honeycomb structure which consists of a ceramic ingredient to JP,61-51240,B, processing the periphery section after baking and making it smooth, it is substantially [ as a matrix member ] the same, and the thermal-shock-resistance rotation heat-regenerative element to which the difference of an thermal expansion coefficient applies and calcinates [ the mineral composition after calcinating to the joint ] the ceramic jointing material for corrugated fibreboard which becomes with 0.1% or less in 800 degrees C is proposed. However, although thermal stress mainly occurs near the periphery section of a passage inlet-port end face and a passage outlet end face, since the honeycomb member was joined in these both-ends side periphery section, this thermal-shock-resistance rotation heat-regenerative element was not what not necessarily eases thermal stress fully, either.

[0007] Moreover, the ceramic honeycomb filter which similarly joined the honeycomb member of cordierite to the SAE paper 860008 in 1986 into cordierite cement is indicated, and it is. However, it was not what is the same as that of the above-mentioned honeycomb structure object etc., and not necessarily eases thermal stress fully too in that this honeycomb filter is joined to the passage inlet-port end-face periphery section and the outlet end-face periphery section.

[0008] Furthermore, the ceramic honeycomb filter which pasted up the inorganic fiber which is each other interwoven with in three dimensions at least in two or more honeycomb ceramic members, and the inorganic particle on JP,8-28246,A by the nature seal member of elasticity which it comes to join mutually together through an inorganic binder and an organic binder is indicated. However, this honeycomb filter also had the trouble that a honeycomb member and a seal member could not ease the thermal stress generated in that end face again not this quality of the material but since it has pasted up to the passage inlet-port end-face periphery section and the outlet end-face periphery section.

[0009]

[Problem(s) to be Solved by the Invention] This invention is made in view of such a conventional technical problem, and the place made into the purpose is to offer the honeycomb structure object excellent in the endurance which the crack initiation by the thermal stress at the time of use does not produce, honeycomb filters, and those manufacture approaches.

[0010]

[Means for Solving the Problem] According to this invention, two or more preparations and two or more of these honeycomb members substantially the honeycomb member which has the circulation hole of a large number divided by the septum with a honeycomb member by the joint material of this quality of the material It is the honeycomb structure object with which it is substantially joined to the direction of passage of a circulation hole in respect of being parallel, and comes to unify these two or more honeycomb members. The honeycomb structure object with which the plane of composition in a honeycomb member is characterized by having the unsealed section at least including the edge linked to the passage inlet-port end-face periphery section and/or the passage outlet end-face periphery section is offered.

[0011] According to this invention, moreover, the circulation hole of a large number which it is divided by the septum and penetrated to a passage inlet-port end face and a passage outlet end face It has two or more \*\*\*\* suggestion \*\*\*\*\* honeycomb filter members alternately by the passage inlet-port end face and passage outlet end face which a circulation hole penetrates. This honeycomb filter member substantially with this honeycomb filter member by the joint material of this quality of the material It is the honeycomb filter with which a field parallel to the direction of passage of this circulation hole is joined, and it comes to unify these two or more honeycomb members. The honeycomb filter with which the plane of composition in this honeycomb filter member is characterized by having the unsealed section at least including the edge linked to the passage inlet-port end-face periphery section or the passage outlet end-face periphery section is offered.

[0012] In these honeycomb structure object and a honeycomb filter ("it may abbreviate to a honeycomb structure object etc." hereafter, and it may say) Si content specified by  $\text{Si}/(\text{Si}+\text{SiC})$  of a honeycomb member by the principal component of a honeycomb member and joint material consisting of metals Si and SiC is 5 - 50 % of the weight. Si content specified by  $\text{Si}/(\text{Si}+\text{SiC})$  of joint material shall be equivalent to the honeycomb member joined, there shall be than it, and they shall be 10 - 80 % of the weight. [ more ]



[0013] Moreover, it sets on the honeycomb structure object of this invention etc. It is desirable that joint material is continuously arranged in a plane of composition. The unsealed section of a plane of composition It is prepared in the direction of passage of a circulation hole by 10% or more of die length to the overall length of the honeycomb structure object in this direction from the passage inlet-port end-face periphery section or the passage outlet end-face periphery section, Or it is desirable to be prepared in the direction of a core of each end face by 10% or more of die length to full [ of the honeycomb structure object in this direction ] from the passage inlet-port end-face periphery section or the passage outlet end-face periphery section.

[0014] Furthermore, in the honeycomb structure object of this invention etc., it is desirable that the restoration member which uses a heat-resistant inorganic material as a principal component at a part of unsealed section [ at least ] of a plane of composition is arranged, and the thing of thing \*\* with the material strength of that the Young's modulus of a restoration member is 80% or less of the Young's modulus of a honeycomb member or a restoration member smaller than the material strength of a honeycomb member for which either is satisfied at least is desirable in this case.

[0015] It is desirable that they are at least one sort of ceramics chosen from the group which the principal component of a honeycomb member becomes from cordierite, a mullite, an alumina, a spinel, silicon carbide, silicon nitride, lithium aluminium silicate, aluminum titanates, and such combination in the honeycomb structure object of this invention etc. further again, or a Fe-Cr-aluminum system metal. Moreover, a catalyst can also be made to support on the septum of a honeycomb member.

[0016] According to this invention, raw material powder, a binder, and water are kneaded, and the obtained kneading object is fabricated, it dries, and a honeycomb object is acquired. On the other hand, subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in a honeycomb object at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as a honeycomb object. Subsequently After joining two or more honeycomb objects through a junctional zone and unifying, the manufacture approach of the honeycomb structure object characterized by calcinating is offered.

[0017] After according to this invention kneading, fabricating the obtained kneading object, drying and using raw material powder, a binder, and water as a honeycomb object, further, a honeycomb object is calcinated and a honeycomb member is obtained. Moreover, subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in a honeycomb member at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as a honeycomb object. Subsequently After joining two or more honeycomb members through a junctional zone and unifying, the manufacture approach of the honeycomb structure object characterized by calcinating is offered.

[0018] After according to this invention kneading, fabricating the obtained kneading object, drying and using raw material powder, a binder, and water as a honeycomb object, the appearance of a honeycomb object is processed further. Furthermore, subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in a honeycomb object at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as a honeycomb object. Subsequently After joining these two or more honeycomb objects through a junctional zone and unifying, the manufacture approach of the honeycomb structure object characterized by calcinating is offered.

[0019] According to this invention, raw material powder, a binder, and water are kneaded, and the obtained kneading object is fabricated, it dries, and a honeycomb object is acquired further again. Subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in this honeycomb object at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as this honeycomb object. Subsequently After joining these two or more honeycomb objects through this junctional zone and unifying, an appearance is processed and the manufacture approach of the honeycomb structure object characterized by calcinating after that is offered.

[0020] Further, after according to this invention kneading, fabricating the obtained kneading object,

drying and using raw material powder, a binder, and water as a honeycomb object further again, it calcinates and a honeycomb member is obtained, after processing the appearance of a honeycomb object. Subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in a honeycomb member at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as a honeycomb object. Subsequently After joining two or more honeycomb members through a junctional zone and unifying, the manufacture approach of the honeycomb structure object characterized by calcinating is offered.

[0021] According to this invention, raw material powder, a binder, and water are kneaded, and the obtained kneading object is fabricated, and it dries, and considers as a honeycomb object further again. Subsequently After calcinating a honeycomb object and considering as a honeycomb member, the appearance of a honeycomb member is processed. Subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in a honeycomb member at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as a honeycomb object. Subsequently After joining these two or more honeycomb members through a junctional zone and unifying, the manufacture approach of the honeycomb structure object characterized by calcinating is offered.

[0022] According to this invention, raw material powder, a binder, and water are kneaded, and the obtained kneading object is fabricated, it dries, and a honeycomb object is acquired. On the other hand, subsequently The circulation hole of a large number penetrated to the passage inlet-port end face and passage outlet end face of a honeycomb object is alternately \*\*\*\*\* (ed) by the passage inlet-port end face and the passage outlet end face, and a \*\*\*\*\* honeycomb object is produced. Subsequently The junctional zone which serves as a honeycomb object from this quality of the material substantially is formed in a part except for the edge which connects with the direction of passage of the circulation hole in a \*\*\*\*\* honeycomb object at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section. Subsequently After joining two or more \*\*\*\*\* honeycomb objects through a junctional zone and unifying, the manufacture approach of the honeycomb filter characterized by calcinating is offered.

[0023] After according to this invention kneading, fabricating the obtained kneading object, drying and using raw material powder, a binder, and water as a honeycomb object, further, a honeycomb object is calcinated and a honeycomb member is obtained. Moreover, subsequently The circulation hole of a large number penetrated to the passage inlet-port end face and passage outlet end face of a honeycomb member is alternately \*\*\*\*\* (ed) by the passage inlet-port end face and the passage outlet end face, and a honeycomb filter member is produced. Subsequently Substantially the junctional zone which serves as a honeycomb object from this quality of the material substantially with the direction of passage of the circulation hole in a honeycomb filter member to an parallel field It forms in a part except for the edge which connects with the passage inlet-port end-face periphery section or the passage outlet end-face periphery section at least, and subsequently, after joining two or more honeycomb filter members through a junctional zone and unifying, the manufacture approach of the honeycomb filter characterized by calcinating is offered.

[0024] According to this invention, raw material powder, a binder, and water are kneaded, and the obtained kneading object is fabricated, it dries, and a honeycomb object is acquired. Furthermore, subsequently The circulation hole of a large number penetrated to the passage inlet-port end face and passage outlet end face of a honeycomb object is alternately \*\*\*\*\* (ed) by the passage inlet-port end face and the passage outlet end face, and a \*\*\*\*\* honeycomb object is produced. Subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in a \*\*\*\*\* honeycomb object at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as a honeycomb object. Subsequently After joining two or more \*\*\*\*\* honeycomb objects through a junctional zone and unifying, an appearance is processed and the manufacture approach of the honeycomb filter characterized by calcinating after that is offered.

[0025] After according to this invention kneading, fabricating the obtained kneading object, drying and using raw material powder, a binder, and water as a honeycomb object further again, the appearance of a

honeycomb object is processed further. Subsequently The circulation hole of a large number penetrated to the passage inlet-port end face and passage outlet end face of a honeycomb object is alternately \*\*\*\*\* (ed) by the passage inlet-port end face and the passage outlet end face, and a \*\*\*\*\* honeycomb object is produced. Subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in a \*\*\*\*\* honeycomb object at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as a honeycomb object. Subsequently After joining two or more \*\*\*\*\* honeycomb objects through a junctional zone and unifying, the manufacture approach of the honeycomb filter characterized by calcinating is offered.

[0026] Further, after according to this invention kneading, fabricating the obtained kneading object, drying and using raw material powder, a binder, and water as a honeycomb object further again, it calcinates and a honeycomb member is obtained, after processing the appearance of a honeycomb object. Subsequently The circulation hole of a large number penetrated to the passage inlet-port end face and passage outlet end face of a honeycomb member is alternately \*\*\*\*\* (ed) by the passage inlet-port end face and the passage outlet end face, and a honeycomb filter member is produced. Subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in a honeycomb filter member at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as a honeycomb object. Subsequently After joining two or more honeycomb filter members through a junctional zone and unifying, the manufacture approach of the honeycomb filter characterized by calcinating is offered.

[0027] According to this invention, raw material powder, a binder, and water are kneaded, and the obtained kneading object is fabricated, and it dries, and considers as a honeycomb object further again. Subsequently After calcinating this honeycomb object and considering as a honeycomb member, the appearance of this honeycomb member is processed. Subsequently The circulation hole of a large number penetrated to the passage inlet-port end face and passage outlet end face of this honeycomb member is alternately \*\*\*\*\* (ed) by the passage inlet-port end face and the passage outlet end face, and a honeycomb filter member is produced. Subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in a honeycomb filter member at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as a honeycomb object. Subsequently After joining two or more honeycomb filter members through a junctional zone and unifying, the manufacture approach of the honeycomb filter characterized by calcinating is offered.

[0028] It is desirable to form a junctional zone continuously by the manufacture approaches, such as these honeycomb structure object. Moreover, the appearance of the acquired honeycomb structure object may be processed further.

[0029] Moreover, it is desirable to apply to a part of side face [ at least ] of a honeycomb structure object etc. the filler which uses a heat-resistant inorganic material as a principal component, and it may support a catalyst after manufacturing a honeycomb structure object etc.

[0030] Moreover, it is desirable to arrange the filler which uses a heat-resistant inorganic material as a principal component in a part of part [ at least ] in which the junctional zone of the field which formed the junctional zone in the part is not formed.

[0031] It is desirable to consist of at least one sort of ceramics chosen from the group which consists of cordierite, a mullite, an alumina, a spinel, silicon carbide, silicon nitride, lithium aluminium silicate, aluminum titanates, and such combination as a honeycomb member and a principal component of a junctional zone, a Fe-Cr-aluminum system metal, or metals Si and SiC.

[0032]

[Embodiment of the Invention] the coefficient of thermal expansion at the time of filter use of a honeycomb member and joint material since the honeycomb structure object of this invention etc. is joined by the joint material of this quality of the material as substantially [ two or more honeycomb members or honeycomb filter members (hereafter, "it can be abbreviating to the honeycomb member etc." and there are things.) ] as a honeycomb member -- abbreviation -- it becomes the same and generating of thermal stress can be controlled.

[0033] As for thermal stress, according to examination, it turns out [ of this invention person ]

wholeheartedly in the passage inlet-port end-face periphery section or the passage outlet end-face periphery section that it is very large. Moreover, in this invention Since it constitutes including at least the edge which connects a plane of composition to this part so that it may have the unsealed section in a part, In addition to the thermal stress reduction effectiveness by the jointing material for corrugated fibreboard mentioned above, the thermal stress generated on a honeycomb structure object etc. still more effectively can be reduced, and it can consider as the honeycomb structure object which a crack etc. does not generate and which is excellent in endurance.

[0034] Hereafter, each requirement for a configuration, such as a honeycomb structure object concerning this invention, is explained in detail.

[0035] the circulation hole of a large number which the honeycomb structure object concerning this invention comes to unify two or more honeycomb members which have the circulation hole of a large number divided by the septum, and the honeycomb filter of this invention is divided by the septum, and are penetrated to a passage inlet-port end face and a passage outlet end face -- a passage inlet-port end face and a passage outlet end face -- alternate -- \*\*\*\* suggestion -- \*\*\*\* -- it comes to unify two or more honeycomb filter members.

[0036] As for the cross-section configuration (cel configuration) of a circulation hole, in the honeycomb member in this invention etc., it is desirable that it is either of the viewpoint on manufacture to triangles, squares, hexagons, or corrugated configurations.

[0037] moreover, the cel consistency of the cel formed by the septum -- the reinforcement as a honeycomb member -- and effective -- in consideration of GSA (geometric surface area) and pressure loss in case gas flows further, 6-2000 cel / square inch (0.9 - 311 cel / cm<sup>2</sup>) is desirable, and 50-400 cel / square inch (7.8 - 62 cel / cm<sup>2</sup>) is still more desirable.

[0038] Moreover, the thing of a configuration from which the shape of a cylindrical shape is cut to trichotomy or quadrisection at shaft orientations so that it may pass along the medial axis, and the cross-section configurations of shaft orientations and a perpendicular direction serve as a sector in it as a configuration of a honeycomb member, for example; the shape of a cylindrical shape can be cut at fixed spacing to shaft orientations at 9 or more \*\*\*\*s, and the cross-section configurations of shaft orientations and a perpendicular direction can mention the thing used as a configuration which is [ rectangular head / a sector ] different by each segment etc. The thing of a configuration which cut the honeycomb member from the point that the thermal stress of a honeycomb filter can be reduced by establishing the contact surface in three dimension in large numbers especially, to 9 or more \*\*\*\*s is desirable.

[0039] On the other hand, the honeycomb member in this invention has desirable silicon carbide at the point that it is desirable to consist of at least one sort of ceramics chosen from the group which consists of cordierite, a mullite, an alumina, a spinel, silicon carbide, silicon nitride, lithium aluminium silicate, aluminum titanates, and such combination, and a Fe-Cr-aluminum system metal, and thermal conductivity tends to radiate heat highly especially from viewpoints, such as reinforcement and thermal resistance.

[0040] Moreover, in this invention, it is also desirable to use Metals Si and SiC as a principal component, in this case, it is desirable that Si content specified by Si/(Si+SiC) of a honeycomb member is 5 - 50 % of the weight, and it is still more desirable to it that it is 10 - 40 % of the weight. Since less than 5 % of the weight of association by Si is insufficient, thermal conductivity and reinforcement may be insufficient, and if it, on the other hand, exceeds 50 % of the weight, it may contract too much, and evils, such as a porosity fall and pore diameter contraction, may be produced.

[0041] In this invention, what especially a limit does not have about the \*\*\*\*\* member which \*\*\*\*\* a circulation hole, for example, consists of the same ceramics and/or same metal as a honeycomb member can be mentioned.

[0042] After fabricating the kneading object kneaded and obtained after the honeycomb member carried out the specified quantity injection of a binder and the water in this invention at the raw material powder which consists of the ceramics and/or metal which were mentioned above and making it into a desired configuration, desiccation of a Plastic solid can be performed, a honeycomb object can be acquired, and, finally it can obtain by calcinating this honeycomb object.

[0043] before junction by the jointing material for corrugated fibreboard later mentioned in order that the honeycomb member in this invention may raise dimensional accuracy -- the appearance -- processing it -- substance is desirable. Moreover, processing of this appearance may be performed to the honeycomb

object fabricated and acquired.

[0044] As a binder used by this invention, a hydroxymethyl cellulose, methyl cellulose, hydroxyethyl cellulose, carboxyl methyl cellulose, or polyvinyl alcohol can be mentioned, and these binders are kind independent or can be used combining two or more sorts, for example.

[0045] Moreover, in addition to this in this invention, the ethylene glycol generally used as a shaping assistant, a dextrin, fatty-acid soap, or polyalcohol may be added if needed.

[0046] To the powder raw material 100 weight section mentioned above, the amount of the water to throw in is 10 - 40 weight section extent, after throwing in water, kneads the obtained mixed raw material with a vacuum kneading machine etc., and usually makes it plasticity.

[0047] The shaping approach has desirable extrusion molding, for example, it can perform it using a ram type extrusion-molding machine, biaxial screw-type continuous-extrusion-molding equipment, etc.

[0048] Moreover, it is desirable to be able to mention hot air drying, microwave desiccation, dielectric drying, reduced pressure drying, a vacuum drying, freeze drying, etc., and to carry out by being independent or combining dielectric drying, microwave, or hot air drying especially as the desiccation approach, for example. Furthermore, what is necessary is just to choose desired conditions suitably about baking conditions according to the class of ingredient to be used.

[0049] Moreover, in the honeycomb filter of this invention, in case a circulation hole is \*\*\*\*\* (ed), the circulation hole of the honeycomb object after shaping desiccation is \*\*\*\*\* (ed), and it is good also as a \*\*\*\*\* honeycomb object, and the circulation hole of the honeycomb member after calcinating further is \*\*\*\*\* (ed), and it is good also as a honeycomb filter member. It is desirable that the bonding strength of a \*\*\*\*\* member \*\*\*\*\* the circulation hole of a honeycomb object, and considers as a \*\*\*\*\* honeycomb object at a large point especially.

[0050] In this invention, it has the unsealed section including the edge which an parallel field is substantially joined to the direction of passage of a circulation hole by the joint material to which two or more honeycomb members etc. turn into a honeycomb member from the principal component of this quality of the material substantially, it comes to be unified, and a plane of composition connects to the passage inlet-port end-face periphery section or the passage outlet end-face periphery section at least by it.

[0051] Here, a "plane of composition" means the field where the jointing material for corrugated fibreboard is arranged in the part among this specification. Moreover, the "unsealed section" means the part in which a jointing material for corrugated fibreboard is not arranged among planes of composition. Furthermore, it is semantics also including the field which is not parallel in semantics strict in the range acting as [ in case two or more honeycomb members are joined to "it is an parallel field substantially" ] a failure.

[0052] In this invention, although what is nonsequentially arranged in the plane of composition by two or more places, the thing currently continuously arranged in the plane of composition, and \*\*\*\*\* are sufficient as joint material, it is the point which can make bonding strength, such as a honeycomb member, high, and what is continuously arranged in the plane of composition is desirable.

[0053] Moreover, as a configuration of joint material, although the cross-section configuration of the shaft orientations of a honeycomb structure object can, for example, mention a triangle, a rectangle, a square, a rhombus, a trapezoid, an ellipse, circular, a truck circle configuration, a half-ellipse form, or a hemicycle, it is the point which is easy to equalize the temperature of the whole filter, and an ellipse, circular, a truck circle configuration, etc. are desirable.

[0054] As for the unsealed section, it is desirable to be formed in the direction of passage of a circulation hole by 10% or more of die length to the overall length of the honeycomb structure object of this direction etc. from the passage inlet-port end-face periphery sections, such as a honeycomb structure object, or the passage outlet end-face periphery section, and it is more desirable to be formed by 30% or more of die length. If it is this range, the thermal stress of the whole, such as a honeycomb structure object, can be reduced effectively, generating of a crack etc. can be controlled, and endurance can be raised.

[0055] Moreover, as for the unsealed section, it is still more desirable to be formed in the direction of a core of each end face by 10% or more of die length to full [ of the honeycomb structure object of this direction etc. ] from the passage inlet-port end-face periphery sections, such as a honeycomb structure object, or the passage outlet end-face periphery section, and it is more desirable to be formed by 30% or more of die length. Thereby, thermal stress can be reduced more and endurance can be raised further.

[0056] Moreover, in this invention, it is desirable that prepare a joint in abbreviation cores, such as a honeycomb structure object, and the unsealed section is prepared including all the parts linked to the side face of the honeycomb structure object in a plane of composition etc., a passage outlet end face, and a passage inlet-port end face. Deformation of each part which thermal stress tends to generate with a honeycomb structure object etc. becomes possible easily by this, and generating of a crack etc. can be controlled to altitude.

[0057] furthermore, this invention -- if it is, the unsealed section is the point which cannot produce a bias easily in deformation of each part, it is desirable to be arranged on the basis of medial axes, such as a honeycomb structure object, at axial symmetry, but as shown in drawing 11 (a) - (d), the unsealed section 12 may be arranged to non-axial symmetry on the basis of medial axes, such as a honeycomb structure object, for example.

[0058] On the other hand, the jointing material for corrugated fibreboard in this invention is the thing of this quality of the material as substantially as a honeycomb member as above-mentioned.

[0059] It consists of at least one sort of ceramics chosen from the group which specifically consists of the cordierite described by the way, the mullite, the alumina, the spinel, the silicon carbide, the silicon nitride, the lithium aluminium silicate, the aluminum titanates, and such combination of a honeycomb member, or a Fe-Cr-aluminum system metal, and the component of a honeycomb member and the thing made to correspond can be mentioned.

[0060] On the other hand, although it is desirable to use Metals Si and SiC as a principal component also as for a jointing material for corrugated fibreboard when a honeycomb member uses Metals Si and SiC as a principal component, in this case, Si content specified by  $\text{Si}/(\text{Si}+\text{SiC})$  is equivalent to the honeycomb member joined, to it, and it is desirable than it to it that it is 10 - 80 % of the weight. If bonding strength sufficient by under the EQC may not be obtained compared with a honeycomb member and Si content exceeds 80 % of the weight, the oxidation resistance in an elevated temperature may become inadequate.

[0061] In this invention, as substantially as a honeycomb object, joint material can prepare it by calcinating, after forming the junctional zone of this quality of the material in a part except for the edge which connects with the direction of passage of the circulation hole in a honeycomb object at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section.

[0062] But in the honeycomb structure object of this invention, after a junctional zone forms in the honeycomb member which calcinated the honeycomb object after shaping and desiccation further, and acquired it, joint material can also be prepared by calcinating. moreover, the honeycomb filter of this invention -- also setting -- the circulation hole of a honeycomb object -- \*\*\*\*\* -- eye the bottom -- \*\*\*\* -- a honeycomb -- the body -- joint material may be prepared by calcinating, after a junctional zone forms, and after a junctional zone forms in the honeycomb filter member which \*\*\*\*\* (ed) the honeycomb member, joint material may be prepared by calcinating.

[0063] Although the slurry of this quality of the material may be substantially applied to a predetermined field directly with a honeycomb object as an approach of forming a junctional zone, in order to secure predetermined thickness, it is desirable to apply the slurry of this quality of the material to this, and to join to it using the plate of the predetermined thickness which is the thing of the same quality of the material, and was formed. Moreover, as for a junctional zone, forming continuously is desirable in order to enlarge bonding strength, such as a honeycomb member.

[0064] The honeycomb structure object of this invention etc. can be calcinated and acquired after unifying the honeycomb object which formed the junctional zone in this way, or the plurality of \*\*. Baking conditions should just choose suitable heat treatment temperature suitably according to the ingredient of a jointing material for corrugated fibreboard that what is necessary is just suitable conditions, when joining. However, it is desirable to carry out at the temperature of 200-400 degrees C generally.

[0065] In this invention, it is desirable that the restoration member which uses a heat-resistant inorganic material as a principal component at a part of unsealed section [ at least ] is arranged. Thereby, the blow by (passing through) from the unsealed section of fluids, such as gas, can be prevented.

[0066] In addition, when arranging a restoration member in the honeycomb filter of this invention, it is desirable to arrange in a part of unsealed section so that all the parts in which the opening formed of the unsealed section at least exposes a restoration member to a passage inlet-port end face may be blockaded.



While being able to prevent by this that soot accumulates on the unsealed section, the thermal stress produced in a honeycomb filter by the opening exposed between the restoration member arranged in the passage inlet-port end-face 16 side and a jointing material for corrugated fibreboard and to the passage outlet end face 14 can be reduced to altitude.

[0067] Being independent, or mixing and using the ceramic fiber which has thermal resistance, ceramic powder, cement, etc. as a restoration member which uses a heat-resistant inorganic material as a principal component, may mix and use an organic binder, an inorganic binder, etc. preferably if needed further.

[0068] Moreover, the thing of thing \*\* with that \*\* Young's modulus is 80% or less of the Young's modulus of a honeycomb member and \*\* material strength smaller than the material strength of a honeycomb member as a restoration member in this invention for which either is satisfied at least is desirable, and it is more desirable to satisfy these both.

[0069] At least, when one of these is satisfied, the thermal stress reduction effectiveness is large and it is because the endurance of a honeycomb structure object etc. improves further. Here, Young's modulus carries out measurement calculation from the relation between a load and the amount of displacement by the static-modulus examining method, and material strength is measured by the four-point bending test (JIS1601) using a material testing machine.

[0070] In this invention, it is also desirable to apply the filler further mentioned above on a part of side face [ at least ] of the acquired honeycomb structure object, and to raise thermal resistance.

[0071] In addition, after a restoration member unifies and calcinates honeycomb objects, such as a honeycomb member, etc., it is filled up with a filler, you may calcinate and arrange if needed further, and after it unifies, and it is filled up with a filler before calcinating, desiccation and, with honeycomb objects, such as a honeycomb member, etc., it may be calcinated and may arrange it.

[0072] Moreover, in this invention, in consideration of dimension doubling, such as a container, etc., after unifying, appearances (honeycomb structure object etc.), such as a honeycomb member, may be processed, and after calcinating further, appearances (honeycomb structure object etc.), such as a honeycomb member, may be processed.

[0073] In this invention, as for the unified honeycomb structure object etc., a vertical cross-section configuration can take various kinds of configurations, such as a circle, an ellipse, and a ball-race truck, in the direction of passage of a circulation hole.

[0074] moreover, the metal which has catalyst ability, such as Pt, Pd, and Rh, in a honeycomb member etc. in this invention when it is going to use such a honeycomb structure object etc. for reforming of purification of the exhaust gas of burners, such as heat engines, such as an internal combustion engine, or a boiler, liquid fuel, or gaseous fuel as catalyst support -- even if few, it is desirable to support one sort.

[0075] Moreover, if the caught particulate matter accumulates on a septum in using as a honeycomb filter, since blinding will be started and the function as a filter will fall, by heating a honeycomb filter with heating means, such as a heater, periodically, combustion removal of the particulate matter is carried out, and it performs reproducing a filter. Therefore, in order to promote combustion of the particulate matter at the time of filter playback, the metal which has such catalyst ability on a septum may be made to support in the case of a honeycomb filter.

[0076] Although this invention is hereafter explained further to a detail based on the operation gestalt shown in a drawing, this invention is not limited to these operation gestalten.

[0077] Drawing 1 (a), (b), (c), and (d) are the perspective views showing the various examples of the honeycomb structure object concerning this invention. The honeycomb structure object 10 shown in drawing 1 (a), (b), (c), and (d) joins four honeycomb members 21 which have the circulation hole 11 of a large number penetrated to the shaft orientations (the direction of passage) (it is drawing 1 (a), (b), (c), and (d), and the direction of X shows.) divided by the septum, and is constituted. Moreover, the honeycomb member 21 is substantially joined to the direction X of passage of the circulation hole 11 by the joint material 25 of this quality of the material in respect of [ 22 ] being parallel (plane of composition) as substantially as the honeycomb member 21, among this plane of composition 22, the unsealed section 12 is formed including the edge 18 linked to the passage outlet end-face periphery section 15, and the joint material 25 is arranged continuously.

[0078] Here, including a part of part which the unsealed section 12 connects to the passage outlet end face 14 and a side face 13 among planes of composition 22, from the side face 13, the honeycomb structure object 10 shown in drawing 1 (a) is aslant formed so that the width of face of the direction Y of



a core of the honeycomb structure object 10 may become small gradually in the passage inlet-port end-face 16 direction. Moreover, although the unsealed section 12 is formed including a part of part which connects with the passage outlet end face 14 and a side face 13 similarly, the configuration of the unsealed section 12 is a rectangle, and the honeycomb structure object 10 shown in drawing 1 (b) is formed from the side face 13 so that the width of face of the direction Y of a core of the honeycomb structure object 10 may become the same in the passage inlet-port end-face 16 direction. Moreover, including the part which the unsealed section 12 connects with the whole part which connects with a side face 13 among planes of composition 22 at the passage outlet end face 14, from the side face 13, the honeycomb structure object 10 shown in drawing 1 (c) is aslant formed so that the width of face of the direction Y of a core of the honeycomb structure object 10 may become small gradually in the passage inlet-port end-face 16 direction. Moreover, including the part which the unsealed section 12 connects to the whole part, the passage outlet end face 14, and the passage inlet-port end face 16 which are connected to a side face 13 among planes of composition 22, from the side face 13, the honeycomb structure object 10 shown in drawing 1 (d) is formed so that the width of face of the direction Y of a core of the honeycomb structure object 10 may become the same in the direction of a passage outlet end face.

[0079] With the honeycomb structure object 10 shown in drawing 1 (a), (b), (c), and (d), even if the ununiformity of temperature distribution like a local elevated temperature or low temperature arises, it can deform freely, without restraining each part of the honeycomb structure object 10 mutually, thermal stress is reduced, and generating of a crack is prevented as much as possible.

[0080] Since the effectiveness of reducing thermal stress by the honeycomb structure object 10 whole especially with the honeycomb structure object 10 shown in drawing 1 (c) and (d) is large, especially in an operating environment by which the ununiformity of temperature attains to the honeycomb structure object 10 whole, it is effective.

[0081] The honeycomb structure object 10 shown in drawing 2 (a) and (b) joins three honeycomb members 21, and is constituted. Like drawing 1 (c), including the part which the unsealed section 12 connects with the whole part which connects with a side face 13 among planes of composition 22 at the passage outlet end face 14, the honeycomb structure object 10 shown in drawing 2 (a) is aslant formed from the side face 13 so that the width of face of the direction Y of a core of the honeycomb structure object 10 may become small gradually in the passage inlet-port end-face 16 direction. Moreover, like drawing 1 (d), including the part which the unsealed section 12 connects to the whole part, the passage outlet end face 14, and the passage inlet-port end face 16 which are connected to a side face 13 among planes of composition 22, from the side face 13, the honeycomb structure object 10 shown in drawing 2 (b) is formed so that the width of face of the direction Y of a core of the honeycomb structure object 10 may become the same in the passage inlet-port end-face 16 direction.

[0082] Also with such a honeycomb structure object, the honeycomb structure object 10 and the same thermal stress reduction effectiveness as abbreviation which are shown in drawing 1 (a), (b), (c), and (d) can be demonstrated.

[0083] Drawing 3 (a) and (b) are the perspective views showing other examples of the honeycomb structure object concerning this invention.

[0084] The honeycomb structure object 10 shown in drawing 3 (a) is established including a part of part which the unsealed section 12 connects to the side face 13 of the honeycomb structure object 10 among planes of composition 22, and all of the parts linked to the passage outlet end face 14. Moreover, in this example, it is prepared so that the unsealed section 12 may connect continuously two points (A, B) of the end-face periphery section 15, and (C, D) and may cross in the center section of the passage outlet end face 14.

[0085] With such a honeycomb structure object 10, it has the advantage that the reduction effectiveness of the thermal stress in the passage outlet end face 14 is large.

[0086] A part of part in which the unsealed section 12 connects further to the side face 13 of the honeycomb structure object 10 the honeycomb structure object 10 shown in drawing 3 (b) among planes of composition 22 It is prepared including all of the parts linked to the passage inlet-port end face 16, and it is prepared so that the end-face periphery section 17 may connect two points (not shown) continuously and the unsealed section 12 may cross in the center section of the passage inlet-port end face 16 like the passage outlet end face 14.

[0087] With such a honeycomb structure object 10, the reduction effectiveness of thermal stress is large

at the passage outlet end face 14 and the passage inlet-port end face 16, and generating of a crack can be controlled further.

[0088] As for the honeycomb structure object 10 shown in drawing 4 (a), (b), (c), and (d), the joint material 25 is formed including all the parts that it is arranged in the core of the honeycomb structure object 10, and the unsealed section 12 connects to the side face 13 of the honeycomb structure object 10, the passage outlet end face 14, and the passage inlet-port end face 16 among planes of composition 22. As for drawing 4 (b), drawing 4 (a) shows the case where as for drawing 4 (c) the cross-section configuration of drawing 4 (d) of the joint material 25 is a rhombus when the cross-section configuration of the joint material 25 is a ball-race truck form, respectively, when the cross-section configuration of the joint material 25 is a rectangle, and the cross-section configuration of the joint material 25 is circular.

[0089] With such a honeycomb structure object 10, the reduction effectiveness of thermal stress is very large, and the ununiformity of temperature is large like a local elevated temperature or low temperature, and when the ununiformity is distributed covering the whole honeycomb structure object, it can consider as the honeycomb structure object which does not produce a crack etc.

[0090] On the other hand, the unsealed section 12 is formed including all of the parts which connect with the side face 13 and the passage outlet end face 14 of the honeycomb structure object 10 among planes of composition 22, and a part of part linked to the passage inlet-port end face 16, a part of joint material 25 exposes to the passage inlet-port end face 16 of the honeycomb structure object 10 the honeycomb structure object 10 shown in drawing 5 (a), (b), (c), and (d), and it is prepared.

[0091] Especially with this honeycomb structure object, it has the advantage that the effectiveness of reducing the thermal stress in the passage outlet end face 14 and a side face 13 is large.

[0092] The honeycomb structure object 10 shown in drawing 6 (a), (b), and drawing 7 (a) and (b) Like the honeycomb structure object 10 shown in drawing 4 (a), (b), (c), and (d) The unsealed section 12 is formed including all the parts linked to the side face 13, the passage outlet end face 14, and the passage inlet-port end face 16 of the honeycomb structure object 10 of a plane of composition 22, and many planes of composition 22 are further established by joining and constituting nine honeycomb members 14.

[0093] The honeycomb structure object 10 which the honeycomb structure object 10 shown in drawing 6 (a) and (b) shows the case where the cross-section configuration of the joint material 25 is a rectangle, like drawing 4 (a), and is shown in drawing 7 (a) and (b) shows the case where the cross-section configuration of the joint material 25 is an ellipse form.

[0094] With this honeycomb structure object 10, since the unsealed section 12 can be formed into the honeycomb structure object 10 at a large number and homogeneity in addition to the effectiveness which the honeycomb structure object 10 shown in drawing 4 (a) - (d) described by the way, the thermal stress of the honeycomb structure object 10 can be reduced extremely.

[0095] The honeycomb structure object 10 shown in drawing 8 (a) and (b) Like the honeycomb structure object 10 shown in drawing 4 (a), (b), (c), and (d) Join four honeycomb members 21 by the joint material 25, and the joint material 25 is arranged in the core of the honeycomb structure object 10. The unsealed section 12 is formed including all the parts linked to the side face 13, the passage outlet end face 14, and the passage inlet-port end face 16 of the honeycomb structure object 10 of a plane of composition 22. Moreover, with this honeycomb structure object 10, the restoration member 24 is arranged in a part of unsealed section 12 so that it may expose to the perimeter of the joint material 25 in a part of side face 13. The non-filling section 31 which the restoration member 24 is not arranged but forms the opening is formed including a part of part which connects with a part of side face 13 of the honeycomb structure object 10 among planes of composition 22, and all of the parts linked to the passage outlet end face 14 and the passage inlet-port end face 16.

[0096] With this honeycomb structure object 10, since the non-filling section 31 is formed in all of the parts linked to the passage outlet end face 14 and the passage inlet-port end face 16 while a fluid cannot flow the unsealed section 12 in the direction of passage and can prevent the blow by of a fluid by existence of the restoration member 24, it has the advantage that the reduction effectiveness of thermal stress is very large.

[0097] Honeycomb structure object 10 shown in drawing 9 (a) and (b) Everything but establishing many planes of composition 22 is taken as the same configuration as the honeycomb structure object 10 shown in drawing 8 (a) and (b) by joining and constituting nine honeycomb members 14 like the honeycomb structure object 10 shown in drawing 6 (a) and (b).

[0098] With this honeycomb structure object 10, since the unsealed section 12 can be formed into the honeycomb structure object 10 at a large number and homogeneity in addition to the effectiveness which the honeycomb structure object 10 shown in drawing 8 (a) and (b) described by the way, the thermal stress of the honeycomb structure object 10 can be reduced extremely.

[0099] Drawing 10 (a), (b), and (c) show the operation gestalt in the case of using as a honeycomb filter. In the honeycomb filter 1 shown in drawing 10 (a), (b), and (c) Like the honeycomb structure object 10 shown in drawing 4 (a), (b), (c), and (d) Four honeycomb filter members 33 are joined by the joint material 25. The joint material 25 is arranged in the core of a honeycomb filter 1, and the unsealed section 12 is formed including all the parts linked to the side face 13, the passage outlet end face 14, and the passage inlet-port end face 16 of a honeycomb filter 1 of a plane of composition 22. Moreover, it exposes between the restoration member 24 which is arranged in a part of unsealed section 12 so that all the parts from which the opening formed of the unsealed section 12 exposes the restoration member 24 to the passage inlet-port end face 16 in this honeycomb filter 1 may be blockaded, and was arranged in the passage inlet-port end-face 16 side, and the joint material 25, and to the passage outlet end face 14, and the non-filling section 31 which a filler is not arranged but forms the opening is formed.

[0100] In this honeycomb filter 1, since the opening is formed near the passage outlet end face 14 and the passage inlet-port end face 16, without the soot in exhaust gas accumulating on the non-filling section 31 by the side of a gas inflow while being able to use suitably as a honeycomb filter, it has the advantage that the reduction effectiveness of thermal stress is very large.

[0101] Next, although the example of the manufacture approach of of the honeycomb structure object and honeycomb filter concerning this invention is explained, this invention is not limited to these.

[0102] (Example 1 of manufacture) As a raw material, the mixed powder of 75 % of the weight of SiC powder and 25 % of the weight of metal Si powder was used, methyl cellulose and hydroxypropoxyl methyl cellulose, a surfactant, and water were added to this, and the reversible plastic matter was produced.

[0103] Subsequently, extrusion molding of this plastic matter is carried out, it has the configuration from which the cross-section configurations of shaft orientations and a perpendicular direction which cut the shape of a cylindrical shape comparatively at fixed spacing to shaft orientations for 9 minutes, and are acquired differ [ rectangular head / a sector ], respectively, and 0.3mm and a cel consistency produced [ the thickness of a septum ] two or more honeycomb objects of 31 cels / cm<sup>2</sup>.

[0104] Subsequently, it dried, after assembling to one by forming the junctional zone of the presentation same into the abbreviation central part of an parallel field as a plastic matter substantially after desiccation by microwave and hot blast with the direction of passage of a circulation hole [ in / for the honeycomb object of these plurality / a honeycomb object ], and joining each of this honeycomb object through this junctional zone after that. It degreased at about 400 degrees C among N<sub>2</sub> ambient atmosphere, and the desiccation object after the acquired assembly was calcinated at about 1550 degrees C in inert atmospheres, such as Ar, after that. The dimension was able to produce the honeycomb structure object shown in 144mmphix152mmL and drawing 9 whose clearance between joints is 2mm by filling up width of face of 5-10mm with the filler which contains for example, the nature fiber of aluminosilicate, SiC powder, metal Si complications, an organic binder, an inorganic binder, and water in the periphery section of the unsealed section after baking, and drying at about 100 degrees C.

[0105] In the example 1 of manufacture, fabricate the honeycomb object of the prism configuration whose end-face configuration is 50mmx50mm, and after joining two or more honeycomb objects and unifying, calcinate and the appearance of the acquired honeycomb structure object is processed.

(Example 2 of manufacture) The dimension was able to produce the honeycomb structure object shown in drawing 9 like the example 1 of manufacture except having produced the honeycomb structure object having considered as the shape of a cylindrical shape of 144mmphix152mmL, and by applying a periphery and subsequently, calcinating the same plastic matter as a junctional zone.

[0106] Like the example 1 of manufacture, fabricate the honeycomb object of the prism configuration whose end-face configuration is 50mmx50mm, and after joining two or more honeycomb objects and unifying, calcinate and the appearance of the acquired honeycomb structure object is processed.

(Example 3 of manufacture) Subsequently the dimension was able to produce the honeycomb structure object shown in drawing 9 like the example 1 of manufacture except having produced the honeycomb structure object having considered as the shape of a cylindrical shape of 144mmphix152mmL, and by

applying a periphery and drying with a filler.

[0107] (Example 4 of manufacture) The honeycomb filter was able to be manufactured by the same above-mentioned approach as the examples 1-3 of manufacture except performing the process which \*\*\*\*\* the both-ends side of honeycomb member passage alternately.

[0108]

[Example] Hereafter, although this invention is further explained to a detail based on a concrete example, this invention is not limited to these examples.

[0109] By the example 1 of example 1 manufacture, the dimension produced the diesel-power-plant exhaust air purification party curate honeycomb filter which \*\*\*\*\* (ed) alternately 144mmphix152mmL and the circulation hole of a large number which 0.3mm and a cel consistency penetrate [ the thickness of a septum ] to the passage inlet-port end face and passage outlet end face of the honeycomb object made from SiC of 31 cels / cm<sup>2</sup> by the passage inlet-port end face and passage outlet end face which a circulation hole penetrates. Moreover, in this honeycomb filter, as shown in drawing 1 (a), a part of part which connects the unsealed section 12 to the passage outlet end face (upper limit side) 14 and a side face 13 among planes of composition 22 is included. From the side face 13, it has prepared aslant so that the width of face of the direction Y of a core of the honeycomb structure object 10 may become small gradually in the passage inlet-port end-face 16 direction. The die length of the unsealed section 12 was set to 50mm in the direction of passage of the honeycomb structure object 10 in the direction of a core of 30mm and the passage outlet end-face (upper limit side) periphery section 15 to the honeycomb structure object 10 from the passage outlet end-face (upper limit side) periphery section 15.

[0110] In examples 2-6 and ten examples 1, respectively Drawing 1 (d), drawing 3 (a), having considered as the structure of having drawing 3 (b), drawing 4 (a), drawing 4 (b), and the unsealed section shown in drawing 7 -- and When the opening formed between the unsealed sections 12 of the honeycomb structure object 10 was exposed and formed in the passage inlet-port end face (lower limit side) 16, the same thing as an example 1 was produced except having arranged the restoration member 25 of the property which shows the part to expose in Table 1 so that it may blockade in a depth of 6mm.

[0111] In addition, a Young's modulus ratio is a ratio of the Young's modulus of a filler to the Young's modulus of a honeycomb member among Table 1, and measurement calculation was carried out from the relation between a load and the amount of displacement by the static-modulus examining method about each Young's modulus. Moreover, reinforcement meant the material strength of the filler to a honeycomb member, and it measured by the four-point bending test (JIS1601) using the material testing machine about each material strength. Moreover, the case where the direction of a filler had large reinforcement was indicated to be "size", and the case of being small was indicated to be "smallness."

[0112] In seven to example 9 example 6, the same thing as an example 6 was produced except having used the thing of the Young's modulus ratio which shows a filler in Table 1, and reinforcement.

[0113] In example 11 example 1, the same thing as an example 1 was produced except having formed the unsealed section 12 by die length of 5mm in the direction of passage of die length of 15mm, and the passage outlet end-face (upper limit side) periphery section 15 to the honeycomb structure object 10 in the direction of a core of the passage outlet end-face (upper limit side) periphery section 15 to the honeycomb structure object 10.

[0114] While making it the structure shown in drawing 3 (a) in an example 12 and 13 examples 1 The same thing as an example 1 was produced except the established thing which formed the unsealed section 12 by die length of 15 or 5mm in the direction of a core of die length of 15 or 5mm, and the upper limit side periphery section 15 to the honeycomb structure object 10 in the direction of passage of the upper limit side periphery section 15 to the honeycomb structure object 10, respectively.

[0115] The same thing as an example 1 was created except having created the thing of integral construction which does not have the example of comparison 1 unsealed section.

[0116] The mat non-expanded made from a ceramic is wound around the side face 13 of the honeycomb structure object (honeycomb filter) 10 as grasping material. (Evaluation) After pushing into the can for cannings made from SUS409 and considering as the canning structure, By making the combustion gas containing the soot generated by combustion of diesel fuel gas oil flow from the lower limit side 16 of the honeycomb structure object (honeycomb filter) 10, and making it flow out from the upper limit side 14 Once carrying out uptake of the soot into the honeycomb structure object (honeycomb filter) 10 and then cooling radiationally to a room temperature, By making the combustion gas which contains the oxygen of

a fixed rate at 800 degrees C from the lower limit side 16 of the honeycomb structure object (honeycomb filter) 10 flow, the filter playback trial which carries out combustion removal of the soot was carried out. [0117] In the honeycomb filter of examples 1-10 and the example 1 of a comparison the transition duration which raises inlet gas temperature from a room temperature to 800 degrees C, and uptake soot weight -- three kinds (transition duration: -- standard conditions (300 seconds) --) the \*\* (240 seconds) shortest (180 seconds) (uptake soot weight: -- standard conditions (10g/L) --) Size (14g/L) and when examining by carrying out the maximum (18 g/L) setup, the existence of generating of the crack in each part of the upper limit side (outlet) of a honeycomb structure object, a lower limit side (inlet port), a periphery, and the interior was investigated.

[0118] On the other hand, in the honeycomb filter of examples 1, 11-13, uptake soot weight was quantitatively set up by six kinds of 10 g/L - 20 g/L (transition duration: standard conditions), and the filter playback trial was carried out like \*\*\*\*. A result is collectively shown in Tables 1 and 2. In addition, about generating of a crack, O showed what was not generated at all and \*\* showed what was generated.

[0119]

[Table 1]

	構造	捕集すす量		最大				大				標準			
		通過 時間		最短				短				標準			
		クラック 調査部位		入口				入口				入口			
		元 填材													
		ヤング率比	強度												
実施例1	図1(a)	80%	小	△	△	△	△	△	○	○	△	○	○	○	○
実施例2	図1(d)	80%	小	△	△	△	△	○	○	○	○	○	○	○	○
実施例3	図3(a)	80%	小	△	○	△	△	△	○	△	△	○	○	○	○
実施例4	図3(b)	80%	小	○	○	△	△	○	○	△	△	○	○	○	○
実施例5	図4(a)	80%	小	○	○	△	△	○	○	○	○	○	○	○	○
実施例6	図4(b)	80%	小	○	○	○	△	○	○	○	○	○	○	○	○
実施例7	図4(b)	83%	小	○	○	△	△	○	○	○	△	○	○	○	○
実施例8	図4(b)	80%	大	○	○	△	△	○	○	△	△	○	○	○	○
実施例9	図4(b)	85%	大	○	△	△	△	○	○	△	△	○	○	○	○
実施例10	図7	80%	小	○	○	○	○	○	○	○	○	○	○	○	○
比較例1	未接合部無し	80%	小	△	△	△	△	△	△	△	△	△	△	○	○

[0120]

[Table 2]

構造		実施例1	実施例11	実施例12	実施例13
未接合部	中心方向長さ	50mm	15mm	15mm	5mm
	流路方向長さ	30mm	5mm	15mm	5mm
ハニカム構造体	直径	144mm	144mm	144mm	144mm
	全長	152mm	152mm	152mm	152mm
捕集すす量 (g/L)	10	○	○	○	○
	12	○	○	○	△
	14	○	△	○	△
	16	○	△	○	△
	18	○	△	○	△
	20	○	△	△	△

[0121] As shown in Table 1, even if it was the case of standard conditions, in the honeycomb structure object of the example 1 of a comparison of unsealed-section-less structure, there was no generating of a crack at the honeycomb filter ( drawing 1 (a), drawing 1 (d), drawing 3 (a), drawing 3 (b), drawing 4 (a), drawing 4 (b), drawing 7 ) of examples 1-10 to generating of a crack being accepted in the end face of an inlet port and an outlet.

[0122] In addition, although generating of a crack might arise in part when a transition duration is shortened, uptake soot weight was made to increase, the ununiformity of temperature became large and the unsealed section was formed only near the end side of the periphery section of a honeycomb filter like drawing 1 (a) and drawing 3 (a) The side face of a honeycomb filter [ in / like drawing 4 (b) / in the unsealed section / a plane of composition ], In the honeycomb filter prepared including all the parts linked to a passage outlet end face and a passage inlet-port end face, a crack was hardly generated, and generating of a crack was not accepted at all in the example which increased the number of planes of composition further like drawing 7 . Moreover, the Young's modulus of a filler was 80% or less of the

Young's modulus of a honeycomb member, or when the material strength of a filler was smaller than the honeycomb member, there was little generating of a crack.

[0123] Moreover, as shown in Table 2, the inclination for the rate which a crack will generate according to increase of the amount of soot if the direction of passage of the upper limit side periphery section 15 to the honeycomb structure object 10 of an unsealed part and main lay length become shorter than predetermined to increase was accepted.

[0124]

[Effect of the Invention] Since each part of a honeycomb structure object and a honeycomb filter can deform freely according to the honeycomb structure object and honeycomb filter of this invention, without being restrained mutually even if the ununiformity of temperature distribution arises as explained above, thermal stress can be reduced, consequently the effectiveness that generating of a crack can be prevented is done so.

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## TECHNICAL FIELD

[Field of the Invention] This invention relates to the honeycomb structure objects for catalyst support and honeycomb filters which are used for the exhaust gas purge of burners, such as heat engines, such as an internal combustion engine, or a boiler, the reformer of liquid fuel or gaseous fuel, etc., and those manufacture approaches.

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## PRIOR ART

[Description of the Prior Art] Conventionally, the honeycomb structure object which supported the catalyst component is used for the exhaust gas purge of burners, such as heat engines, such as an internal combustion engine, or a boiler, the reformer of liquid fuel or gaseous fuel, etc. Moreover, in order to carry out uptake removal of the particulate matter contained in dust-containing fluid like the exhaust gas discharged from a diesel power plant, using a honeycomb filter is known.

[0003] It was exposed to a temperature change with rapid exhaust gas, or local generation of heat, and was easy to produce uneven temperature distribution inside, and the honeycomb structure object or honeycomb filter used for such the purpose had the problem of a crack occurring owing to it. When used as a honeycomb filter which carries out the collection of the particulate matter under exhaust air of a diesel power plant especially, it was required to burn the collected carbon particle and to remove, and since local elevated-temperature-ization was not avoided in this case, it is easy to generate big thermal stress, and was easy to generate a crack. Here, generating of thermal stress is because each part of each other is restrained by the ununiformity of temperature distribution and cannot deform freely with it to thermal-expansion deformation of each part of a honeycomb structure object differing.

[0004] Moreover, when a honeycomb structure object is enlarged by the purpose of use, creating the honeycomb structure object or honeycomb filter which joined two or more honeycomb members by joint material, and was unified is known, and the device which reduces the thermal stress generated also in this case is needed.

[0005] As a policy which reduces thermal stress, the manufacture approach of the honeycomb structure object which joins many honeycomb members to the conventional No. 4335783, for example, USP, official report by discontinuous joint material is indicated. However, since it was not taken into consideration that thermal stress occurs with this honeycomb structure object near the both-ends side periphery section which a circulation hole mainly penetrates, it was not what not necessarily eases thermal stress fully. Moreover, since joint material was prepared in discontinuity, the bonding strength of a honeycomb member was not enough and the mechanical strength of the honeycomb structure object acquired was not necessarily enough.

[0006] Moreover, after carrying out extrusion molding of the matrix member of the honeycomb structure which consists of a ceramic ingredient to JP,61-51240,B, processing the periphery section after baking and making it smooth, it is substantially [ as a matrix member ] the same, and the thermal-shock-resistance rotation heat-regenerative element to which the difference of an thermal expansion coefficient



applies and calcinates [ the mineral composition after calcinating to the joint ] the ceramic jointing material for corrugated fibreboard which becomes with 0.1% or less in 800 degrees C is proposed. However, although thermal stress mainly occurs near the periphery section of a passage inlet-port end face and a passage outlet end face, since the honeycomb member was joined in these both-ends side periphery section, this thermal-shock-resistance rotation heat-regenerative element was not what not necessarily eases thermal stress fully, either.

[0007] Moreover, the ceramic honeycomb filter which similarly joined the honeycomb member of cordierite to the SAE paper 860008 in 1986 into cordierite cement is indicated, and it is. However, it was not what is the same as that of the above-mentioned honeycomb structure object etc., and not necessarily eases thermal stress fully too in that this honeycomb filter is joined to the passage inlet-port end-face periphery section and the outlet end-face periphery section.

[0008] Furthermore, the ceramic honeycomb filter which pasted up the inorganic fiber which is each other interwoven with in three dimensions at least in two or more honeycomb ceramic members, and the inorganic particle on JP,8-28246,A by the nature seal member of elasticity which it comes to join mutually together through an inorganic binder and an organic binder is indicated. However, this honeycomb filter also had the trouble that a honeycomb member and a seal member could not ease the thermal stress generated in that end face again not this quality of the material but since it has pasted up to the passage inlet-port end-face periphery section and the outlet end-face periphery section.

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## EFFECT OF THE INVENTION

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[Effect of the Invention] Since each part of a honeycomb structure object and a honeycomb filter can deform freely according to the honeycomb structure object and honeycomb filter of this invention, without being restrained mutually even if the ununiformity of temperature distribution arises as explained above, thermal stress can be reduced, consequently the effectiveness that generating of a crack can be prevented is done so.

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## TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] This invention is made in view of such a conventional technical problem, and the place made into the purpose is to offer the honeycomb structure object excellent in the endurance which the crack initiation by the thermal stress at the time of use does not produce, honeycomb filters, and those manufacture approaches.

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## MEANS

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[Means for Solving the Problem] According to this invention, two or more preparations and two or more of these honeycomb members substantially the honeycomb member which has the circulation hole of a large number divided by the septum with a honeycomb member by the joint material of this quality of the material It is the honeycomb structure object with which it is substantially joined to the direction of passage of a circulation hole in respect of being parallel, and comes to unify these two or more honeycomb members. The honeycomb structure object with which the plane of composition in a honeycomb member is characterized by having the unsealed section at least including the edge linked to the passage inlet-port end-face periphery section and/or the passage outlet end-face periphery section is offered.

[0011] According to this invention, moreover, the circulation hole of a large number which it is divided by the septum and penetrated to a passage inlet-port end face and a passage outlet end face It has two or more \*\*\*\* suggestion \*\*\*\*\* honeycomb filter members alternately by the passage inlet-port end face and passage outlet end face which a circulation hole penetrates. This honeycomb filter member substantially with this honeycomb filter member by the joint material of this quality of the material It is the honeycomb filter with which a field parallel to the direction of passage of this circulation hole is



joined, and it comes to unify these two or more honeycomb members. The honeycomb filter with which the plane of composition in this honeycomb filter member is characterized by having the unsealed section at least including the edge linked to the passage inlet-port end-face periphery section or the passage outlet end-face periphery section is offered.

[0012] In these honeycomb structure object and a honeycomb filter ("it may abbreviate to a honeycomb structure object etc." hereafter, and it may say) Si content specified by  $\text{Si}/(\text{Si}+\text{SiC})$  of a honeycomb member by the principal component of a honeycomb member and joint material consisting of metals Si and SiC is 5 - 50 % of the weight. Si content specified by  $\text{Si}/(\text{Si}+\text{SiC})$  of joint material shall be equivalent to the honeycomb member joined, there shall be than it, and they shall be 10 - 80 % of the weight. [ more ]

[0013] Moreover, it sets on the honeycomb structure object of this invention etc. It is desirable that joint material is continuously arranged in a plane of composition. The unsealed section of a plane of composition It is prepared in the direction of passage of a circulation hole by 10% or more of die length to the overall length of the honeycomb structure object in this direction from the passage inlet-port end-face periphery section or the passage outlet end-face periphery section, Or it is desirable to be prepared in the direction of a core of each end face by 10% or more of die length to full [ of the honeycomb structure object in this direction ] from the passage inlet-port end-face periphery section or the passage outlet end-face periphery section.

[0014] Furthermore, in the honeycomb structure object of this invention etc., it is desirable that the restoration member which uses a heat-resistant inorganic material as a principal component at a part of unsealed section [ at least ] of a plane of composition is arranged, and the thing of thing \*\* with the material strength of that the Young's modulus of a restoration member is 80% or less of the Young's modulus of a honeycomb member or a restoration member smaller than the material strength of a honeycomb member for which either is satisfied at least is desirable in this case.

[0015] It is desirable that they are at least one sort of ceramics chosen from the group which the principal component of a honeycomb member becomes from cordierite, a mullite, an alumina, a spinel, silicon carbide, silicon nitride, lithium aluminium silicate, aluminum titanates, and such combination in the honeycomb structure object of this invention etc. further again, or a Fe-Cr-aluminum system metal. Moreover, a catalyst can also be made to support on the septum of a honeycomb member.

[0016] According to this invention, raw material powder, a binder, and water are kneaded, and the obtained kneading object is fabricated, it dries, and a honeycomb object is acquired. On the other hand, subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in a honeycomb object at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as a honeycomb object. Subsequently After joining two or more honeycomb objects through a junctional zone and unifying, the manufacture approach of the honeycomb structure object characterized by calcinating is offered.

[0017] After according to this invention kneading, fabricating the obtained kneading object, drying and using raw material powder, a binder, and water as a honeycomb object, further, a honeycomb object is calcinated and a honeycomb member is obtained. Moreover, subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in a honeycomb member at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as a honeycomb object. Subsequently After joining two or more honeycomb members through a junctional zone and unifying, the manufacture approach of the honeycomb structure object characterized by calcinating is offered.

[0018] After according to this invention kneading, fabricating the obtained kneading object, drying and using raw material powder, a binder, and water as a honeycomb object, the appearance of a honeycomb object is processed further. Furthermore, subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in a honeycomb object at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as a honeycomb object. Subsequently After joining these two or more honeycomb objects through a junctional zone and unifying, the manufacture approach of the honeycomb structure object characterized by calcinating is offered.

[0019] According to this invention, raw material powder, a binder, and water are kneaded, and the

obtained kneading object is fabricated, it dries, and a honeycomb object is acquired further again. Subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in this honeycomb object at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as this honeycomb object. Subsequently After joining these two or more honeycomb objects through this junctional zone and unifying, an appearance is processed and the manufacture approach of the honeycomb structure object characterized by calcinating after that is offered.

[0020] Further, after according to this invention kneading, fabricating the obtained kneading object, drying and using raw material powder, a binder, and water as a honeycomb object further again, it calcinates and a honeycomb member is obtained, after processing the appearance of a honeycomb object. Subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in a honeycomb member at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as a honeycomb object. Subsequently After joining two or more honeycomb members through a junctional zone and unifying, the manufacture approach of the honeycomb structure object characterized by calcinating is offered.

[0021] According to this invention, raw material powder, a binder, and water are kneaded, and the obtained kneading object is fabricated, and it dries, and considers as a honeycomb object further again. Subsequently After calcinating a honeycomb object and considering as a honeycomb member, the appearance of a honeycomb member is processed. Subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in a honeycomb member at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as a honeycomb object. Subsequently After joining these two or more honeycomb members through a junctional zone and unifying, the manufacture approach of the honeycomb structure object characterized by calcinating is offered.

[0022] According to this invention, raw material powder, a binder, and water are kneaded, and the obtained kneading object is fabricated, it dries, and a honeycomb object is acquired. On the other hand, subsequently The circulation hole of a large number penetrated to the passage inlet-port end face and passage outlet end face of a honeycomb object is alternately \*\*\*\*\* (ed) by the passage inlet-port end face and the passage outlet end face, and a \*\*\*\*\* honeycomb object is produced. Subsequently The junctional zone which serves as a honeycomb object from this quality of the material substantially is formed in a part except for the edge which connects with the direction of passage of the circulation hole in a \*\*\*\*\* honeycomb object at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section. Subsequently After joining two or more \*\*\*\*\* honeycomb objects through a junctional zone and unifying, the manufacture approach of the honeycomb filter characterized by calcinating is offered.

[0023] After according to this invention kneading, fabricating the obtained kneading object, drying and using raw material powder, a binder, and water as a honeycomb object, further, a honeycomb object is calcinated and a honeycomb member is obtained. Moreover, subsequently The circulation hole of a large number penetrated to the passage inlet-port end face and passage outlet end face of a honeycomb member is alternately \*\*\*\*\* (ed) by the passage inlet-port end face and the passage outlet end face, and a honeycomb filter member is produced. Subsequently Substantially the junctional zone which serves as a honeycomb object from this quality of the material substantially with the direction of passage of the circulation hole in a honeycomb filter member to an parallel field It forms in a part except for the edge which connects with the passage inlet-port end-face periphery section or the passage outlet end-face periphery section at least, and subsequently, after joining two or more honeycomb filter members through a junctional zone and unifying, the manufacture approach of the honeycomb filter characterized by calcinating is offered.

[0024] According to this invention, raw material powder, a binder, and water are kneaded, and the obtained kneading object is fabricated, it dries, and a honeycomb object is acquired. Furthermore, subsequently The circulation hole of a large number penetrated to the passage inlet-port end face and passage outlet end face of a honeycomb object is alternately \*\*\*\*\* (ed) by the passage inlet-port end

face and the passage outlet end face, and a \*\*\*\*\* honeycomb object is produced. Subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in a \*\*\*\*\* honeycomb object at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as a honeycomb object. Subsequently After joining two or more \*\*\*\*\* honeycomb objects through a junctional zone and unifying, an appearance is processed and the manufacture approach of the honeycomb filter characterized by calcinating after that is offered.

[0025] After according to this invention kneading, fabricating the obtained kneading object, drying and using raw material powder, a binder, and water as a honeycomb object further again, the appearance of a honeycomb object is processed further. Subsequently The circulation hole of a large number penetrated to the passage inlet-port end face and passage outlet end face of a honeycomb object is alternately \*\*\*\*\* (ed) by the passage inlet-port end face and the passage outlet end face, and a \*\*\*\*\* honeycomb object is produced. Subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in a \*\*\*\*\* honeycomb object at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as a honeycomb object.

Subsequently After joining two or more \*\*\*\*\* honeycomb objects through a junctional zone and unifying, the manufacture approach of the honeycomb filter characterized by calcinating is offered.

[0026] Further, after according to this invention kneading, fabricating the obtained kneading object, drying and using raw material powder, a binder, and water as a honeycomb object further again, it calcinates and a honeycomb member is obtained, after processing the appearance of a honeycomb object. Subsequently The circulation hole of a large number penetrated to the passage inlet-port end face and passage outlet end face of a honeycomb member is alternately \*\*\*\*\* (ed) by the passage inlet-port end face and the passage outlet end face, and a honeycomb filter member is produced. Subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in a honeycomb filter member at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as a honeycomb object. Subsequently After joining two or more honeycomb filter members through a junctional zone and unifying, the manufacture approach of the honeycomb filter characterized by calcinating is offered.

[0027] According to this invention, raw material powder, a binder, and water are kneaded, and the obtained kneading object is fabricated, and it dries, and considers as a honeycomb object further again. Subsequently After calcinating this honeycomb object and considering as a honeycomb member, the appearance of this honeycomb member is processed. Subsequently The circulation hole of a large number penetrated to the passage inlet-port end face and passage outlet end face of this honeycomb member is alternately \*\*\*\*\* (ed) by the passage inlet-port end face and the passage outlet end face, and a honeycomb filter member is produced. Subsequently The junctional zone of this quality of the material is formed in a part except for the edge which connects with the direction of passage of the circulation hole in a honeycomb filter member at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section as substantially as a honeycomb object. Subsequently After joining two or more honeycomb filter members through a junctional zone and unifying, the manufacture approach of the honeycomb filter characterized by calcinating is offered.

[0028] It is desirable to form a junctional zone continuously by the manufacture approaches, such as these honeycomb structure object. Moreover, the appearance of the acquired honeycomb structure object may be processed further.

[0029] Moreover, it is desirable to apply to a part of side face [ at least ] of a honeycomb structure object etc. the filler which uses a heat-resistant inorganic material as a principal component, and it may support a catalyst after manufacturing a honeycomb structure object etc.

[0030] Moreover, it is desirable to arrange the filler which uses a heat-resistant inorganic material as a principal component in a part of part [ at least ] in which the junctional zone of the field which formed the junctional zone in the part is not formed.

[0031] It is desirable to consist of at least one sort of ceramics chosen from the group which consists of cordierite, a mullite, an alumina, a spinel, silicon carbide, silicon nitride, lithium aluminium silicate, aluminum titanates, and such combination as a honeycomb member and a principal component of a

junctional zone, a Fe-Cr-aluminum system metal, or metals Si and SiC.

[0032]

[Embodiment of the Invention] the coefficient of thermal expansion at the time of filter use of a honeycomb member and joint material since the honeycomb structure object of this invention etc. is joined by the joint material of this quality of the material as substantially [ two or more honeycomb members or honeycomb filter members (hereafter, "it can be abbreviating to the honeycomb member etc." and there are things.) ] as a honeycomb member -- abbreviation -- it becomes the same and generating of thermal stress can be controlled.

[0033] As for thermal stress, according to examination, it turns out [ of this invention person ] wholeheartedly in the passage inlet-port end-face periphery section or the passage outlet end-face periphery section that it is very large. Moreover, in this invention Since it constitutes including at least the edge which connects a plane of composition to this part so that it may have the unsealed section in a part, In addition to the thermal stress reduction effectiveness by the jointing material for corrugated fibreboard mentioned above, the thermal stress generated on a honeycomb structure object etc. still more effectively can be reduced, and it can consider as the honeycomb structure object which a crack etc. does not generate and which is excellent in endurance.

[0034] Hereafter, each requirement for a configuration, such as a honeycomb structure object concerning this invention, is explained in detail.

[0035] the circulation hole of a large number which the honeycomb structure object concerning this invention comes to unify two or more honeycomb members which have the circulation hole of a large number divided by the septum, and the honeycomb filter of this invention is divided by the septum, and are penetrated to a passage inlet-port end face and a passage outlet end face -- a passage inlet-port end face and a passage outlet end face -- alternate -- \*\*\*\* suggestion -- \*\*\*\* -- it comes to unify two or more honeycomb filter members.

[0036] As for the cross-section configuration (cel configuration) of a circulation hole, in the honeycomb member in this invention etc., it is desirable that it is either of the viewpoint on manufacture to triangles, squares, hexagons, or corrugated configurations.

[0037] moreover, the cel consistency of the cel formed by the septum -- the reinforcement as a honeycomb member -- and effective -- in consideration of GSA (geometric surface area) and pressure loss in case gas flows further, 6-2000 cel / square inch (0.9 - 311 cel / cm<sup>2</sup>) is desirable, and 50-400 cel / square inch (7.8 - 62 cel / cm<sup>2</sup>) is still more desirable.

[0038] Moreover, the thing of a configuration from which the shape of a cylindrical shape is cut to trichotomy or quadrisection at shaft orientations so that it may pass along the medial axis, and the cross-section configurations of shaft orientations and a perpendicular direction serve as a sector in it as a configuration of a honeycomb member, for example; the shape of a cylindrical shape can be cut at fixed spacing to shaft orientations at 9 or more \*\*\*\*s, and the cross-section configurations of shaft orientations and a perpendicular direction can mention the thing used as a configuration which is [ rectangular head / a sector ] different by each segment etc. The thing of a configuration which cut the honeycomb member from the point that the thermal stress of a honeycomb filter can be reduced by establishing the contact surface in three dimension in large numbers especially, to 9 or more \*\*\*\*s is desirable.

[0039] On the other hand, the honeycomb member in this invention has desirable silicon carbide at the point that it is desirable to consist of at least one sort of ceramics chosen from the group which consists of cordierite, a mullite, an alumina, a spinel, silicon carbide, silicon nitride, lithium aluminium silicate, aluminum titanates, and such combination, and a Fe-Cr-aluminum system metal, and thermal conductivity tends to radiate heat highly especially from viewpoints, such as reinforcement and thermal resistance.

[0040] Moreover, in this invention, it is also desirable to use Metals Si and SiC as a principal component, in this case, it is desirable that Si content specified by Si/(Si+SiC) of a honeycomb member is 5 - 50 % of the weight, and it is still more desirable to it that it is 10 - 40 % of the weight. Since less than 5 % of the weight of association by Si is insufficient, thermal conductivity and reinforcement may be insufficient, and if it, on the other hand, exceeds 50 % of the weight, it may contract too much, and evils, such as a porosity fall and pore diameter contraction, may be produced.

[0041] In this invention, what especially a limit does not have about the \*\*\*\*\* member which \*\*\*\*\* a circulation hole, for example, consists of the same ceramics and/or same metal as a honeycomb member

can be mentioned.

[0042] After fabricating the kneading object kneaded and obtained after the honeycomb member carried out the specified quantity injection of a binder and the water in this invention at the raw material powder which consists of the ceramics and/or metal which were mentioned above and making it into a desired configuration, desiccation of a Plastic solid can be performed, a honeycomb object can be acquired, and, finally it can obtain by calcinating this honeycomb object.

[0043] before junction by the jointing material for corrugated fibreboard later mentioned in order that the honeycomb member in this invention may raise dimensional accuracy -- the appearance -- processing it -- substance is desirable. Moreover, processing of this appearance may be performed to the honeycomb object fabricated and acquired.

[0044] As a binder used by this invention, a hydroxymethyl cellulose, methyl cellulose, hydroxyethyl cellulose, carboxyl methyl cellulose, or polyvinyl alcohol can be mentioned, and these binders are kind independent or can be used combining two or more sorts, for example. <BR> [0045] Moreover, in addition to this in this invention, the ethylene glycol generally used as a shaping assistant, a dextrin, fatty-acid soap, or polyalcohol may be added if needed.

[0046] To the powder raw material 100 weight section mentioned above, the amount of the water to throw in is 10 - 40 weight section extent, after throwing in water, kneads the obtained mixed raw material with a vacuum kneading machine etc., and usually makes it plasticity.

[0047] The shaping approach has desirable extrusion molding, for example, it can perform it using a ram type extrusion-molding machine, biaxial screw-type continuous-extrusion-molding equipment, etc.

[0048] Moreover, it is desirable to be able to mention hot air drying, microwave desiccation, dielectric drying, reduced pressure drying, a vacuum drying, freeze drying, etc., and to carry out by being independent or combining dielectric drying, microwave, or hot air drying especially as the desiccation approach, for example. Furthermore, what is necessary is just to choose desired conditions suitably about baking conditions according to the class of ingredient to be used.

[0049] Moreover, in the honeycomb filter of this invention, in case a circulation hole is \*\*\*\*\* (ed), the circulation hole of the honeycomb object after shaping desiccation is \*\*\*\*\* (ed), and it is good also as a \*\*\*\*\* honeycomb object, and the circulation hole of the honeycomb member after calcinating further is \*\*\*\*\* (ed), and it is good also as a honeycomb filter member. It is desirable that the bonding strength of a \*\*\*\*\* member \*\*\*\*\* the circulation hole of a honeycomb object, and considers as a \*\*\*\*\* honeycomb object at a large point especially.

[0050] In this invention, it has the unsealed section including the edge which an parallel field is substantially joined to the direction of passage of a circulation hole by the joint material to which two or more honeycomb members etc. turn into a honeycomb member from the principal component of this quality of the material substantially, it comes to be unified, and a plane of composition connects to the passage inlet-port end-face periphery section or the passage outlet end-face periphery section at least by it.

[0051] Here, a "plane of composition" means the field where the jointing material for corrugated fibreboard is arranged in the part among this specification. Moreover, the "unsealed section" means the part in which a jointing material for corrugated fibreboard is not arranged among planes of composition. Furthermore, it is semantics also including the field which is not parallel in semantics strict in the range acting as [ in case two or more honeycomb members are joined to "it is an parallel field substantially" ] a failure.

[0052] In this invention, although what is nonsequentially arranged in the plane of composition by two or more places, the thing currently continuously arranged in the plane of composition, and \*\*\*\*\* are sufficient as joint material, it is the point which can make bonding strength, such as a honeycomb member, high, and what is continuously arranged in the plane of composition is desirable.

[0053] Moreover, as a configuration of joint material, although the cross-section configuration of the shaft orientations of a honeycomb structure object can, for example, mention a triangle, a rectangle, a square, a rhombus, a trapezoid, an ellipse, circular, a truck circle configuration, a half-ellipse form, or a hemicycle, it is the point which is easy to equalize the temperature of the whole filter, and an ellipse, circular, a truck circle configuration, etc. are desirable.

[0054] As for the unsealed section, it is desirable to be formed in the direction of passage of a circulation hole by 10% or more of die length to the overall length of the honeycomb structure object of this direction etc. from the passage inlet-port end-face periphery sections, such as a honeycomb structure

object, or the passage outlet end-face periphery section, and it is more desirable to be formed by 30% or more of die length. If it is this range, the thermal stress of the whole, such as a honeycomb structure object, can be reduced effectively, generating of a crack etc. can be controlled, and endurance can be raised.

[0055] Moreover, as for the unsealed section, it is still more desirable to be formed in the direction of a core of each end face by 10% or more of die length to full [ of the honeycomb structure object of this direction etc. ] from the passage inlet-port end-face periphery sections, such as a honeycomb structure object, or the passage outlet end-face periphery section, and it is more desirable to be formed by 30% or more of die length. Thereby, thermal stress can be reduced more and endurance can be raised further.

[0056] Moreover, in this invention, it is desirable that prepare a joint in abbreviation cores, such as a honeycomb structure object, and the unsealed section is prepared including all the parts linked to the side face of the honeycomb structure object in a plane of composition etc., a passage outlet end face, and a passage inlet-port end face. Deformation of each part which thermal stress tends to generate with a honeycomb structure object etc. becomes possible easily by this, and generating of a crack etc. can be controlled to altitude.

[0057] furthermore, this invention -- if it is, the unsealed section is the point which cannot produce a bias easily in deformation of each part, it is desirable to be arranged on the basis of medial axes, such as a honeycomb structure object, at axial symmetry, but as shown in drawing 11 (a) - (d), the unsealed section 12 may be arranged to non-axial symmetry on the basis of medial axes, such as a honeycomb structure object, for example.

[0058] On the other hand, the jointing material for corrugated fibreboard in this invention is the thing of this quality of the material as substantially as a honeycomb member as above-mentioned.

[0059] It consists of at least one sort of ceramics chosen from the group which specifically consists of the cordierite described by the way, the mullite, the alumina, the spinel, the silicon carbide, the silicon nitride, the lithium aluminium silicate, the aluminum titanates, and such combination of a honeycomb member, or a Fe-Cr-aluminum system metal, and the component of a honeycomb member and the thing made to correspond can be mentioned.

[0060] On the other hand, although it is desirable to use Metals Si and SiC as a principal component also as for a jointing material for corrugated fibreboard when a honeycomb member uses Metals Si and SiC as a principal component, in this case, Si content specified by  $\text{Si}/(\text{Si}+\text{SiC})$  is equivalent to the honeycomb member joined, to it, and it is desirable than it to it that it is 10 - 80 % of the weight. If bonding strength sufficient by under the EQC may not be obtained compared with a honeycomb member and Si content exceeds 80 % of the weight, the oxidation resistance in an elevated temperature may become inadequate.

[0061] In this invention, as substantially as a honeycomb object, joint material can prepare it by calcinating, after forming the junctional zone of this quality of the material in a part except for the edge which connects with the direction of passage of the circulation hole in a honeycomb object at least substantially in an parallel field at the passage inlet-port end-face periphery section or the passage outlet end-face periphery section.

[0062] But in the honeycomb structure object of this invention, after a junctional zone forms in the honeycomb member which calcinated the honeycomb object after shaping and desiccation further, and acquired it, joint material can also be prepared by calcinating. moreover, the honeycomb filter of this invention -- also setting -- the circulation hole of a honeycomb object -- \*\*\*\*\* -- eye the bottom -- \*\*\*\* -- a honeycomb -- the body -- joint material may be prepared by calcinating, after a junctional zone forms, and after a junctional zone forms in the honeycomb filter member which \*\*\*\*\* (ed) the honeycomb member, joint material may be prepared by calcinating.

[0063] Although the slurry of this quality of the material may be substantially applied to a predetermined field directly with a honeycomb object as an approach of forming a junctional zone, in order to secure predetermined thickness, it is desirable to apply the slurry of this quality of the material to this, and to join to it using the plate of the predetermined thickness which is the thing of the same quality of the material, and was formed. Moreover, as for a junctional zone, forming continuously is desirable in order to enlarge bonding strength, such as a honeycomb member.

[0064] The honeycomb structure object of this invention etc. can be calcinated and acquired after unifying the honeycomb object which formed the junctional zone in this way, or the plurality of \*\*. Baking conditions should just choose suitable heat treatment temperature suitably according to the



ingredient of a jointing material for corrugated fibreboard that what is necessary is just suitable conditions, when joining. However, it is desirable to carry out at the temperature of 200-400 degrees C generally.

[0065] In this invention, it is desirable that the restoration member which uses a heat-resistant inorganic material as a principal component at a part of unsealed section [ at least ] is arranged. Thereby, the blow by (passing through) from the unsealed section of fluids, such as gas, can be prevented.

[0066] In addition, when arranging a restoration member in the honeycomb filter of this invention, it is desirable to arrange in a part of unsealed section so that all the parts in which the opening formed of the unsealed section at least exposes a restoration member to a passage inlet-port end face may be blockaded. While being able to prevent by this that soot accumulates on the unsealed section, the thermal stress produced in a honeycomb filter by the opening exposed between the restoration member arranged in the passage inlet-port end-face 16 side and a jointing material for corrugated fibreboard and to the passage outlet end face 14 can be reduced to altitude.

[0067] Being independent, or mixing and using the ceramic fiber which has thermal resistance, ceramic powder, cement, etc. as a restoration member which uses a heat-resistant inorganic material as a principal component, may mix and use an organic binder, an inorganic binder, etc. preferably if needed further.

[0068] Moreover, the thing of thing \*\* with that \*\* Young's modulus is 80% or less of the Young's modulus of a honeycomb member and \*\* material strength smaller than the material strength of a honeycomb member as a restoration member in this invention for which either is satisfied at least is desirable, and it is more desirable to satisfy these both.

[0069] At least, when one of these is satisfied, the thermal stress reduction effectiveness is large and it is because the endurance of a honeycomb structure object etc. improves further. Here, Young's modulus carries out measurement calculation from the relation between a load and the amount of displacement by the static-modulus examining method, and material strength is measured by the four-point bending test (JIS1601) using a material testing machine.

[0070] In this invention, it is also desirable to apply the filler further mentioned above on a part of side face [ at least ] of the acquired honeycomb structure object, and to raise thermal resistance.

[0071] In addition, after a restoration member unifies and calcinates honeycomb objects, such as a honeycomb member, etc., it is filled up with a filler, you may calcinate and arrange if needed further, and after it unifies, and it is filled up with a filler before calcinating, desiccation and, with honeycomb objects, such as a honeycomb member, etc., it may be calcinated and may arrange it.

[0072] Moreover, in this invention, in consideration of dimension doubling, such as a container, etc., after unifying, appearances (honeycomb structure object etc.), such as a honeycomb member, may be processed, and after calcinating further, appearances (honeycomb structure object etc.), such as a honeycomb member, may be processed.

[0073] In this invention, as for the unified honeycomb structure object etc., a vertical cross-section configuration can take various kinds of configurations, such as a circle, an ellipse, and a ball-race truck, in the direction of passage of a circulation hole.

[0074] moreover, the metal which has catalyst ability, such as Pt, Pd, and Rh, in a honeycomb member etc. in this invention when it is going to use such a honeycomb structure object etc. for reforming of purification of the exhaust gas of burners, such as heat engines, such as an internal combustion engine, or a boiler, liquid fuel, or gaseous fuel as catalyst support -- even if few, it is desirable to support one sort.

[0075] Moreover, if the caught particulate matter accumulates on a septum in using as a honeycomb filter, since blinding will be started and the function as a filter will fall, by heating a honeycomb filter with heating means, such as a heater, periodically, combustion removal of the particulate matter is carried out, and it performs reproducing a filter. Therefore, in order to promote combustion of the particulate matter at the time of filter playback, the metal which has such catalyst ability on a septum may be made to support in the case of a honeycomb filter.

[0076] Although this invention is hereafter explained further to a detail based on the operation gestalt shown in a drawing, this invention is not limited to these operation gestalten.

[0077] Drawing 1 (a), (b), (c), and (d) are the perspective views showing the various examples of the honeycomb structure object concerning this invention. The honeycomb structure object 10 shown in drawing 1 (a), (b), (c), and (d) joins four honeycomb members 21 which have the circulation hole 11 of a large number penetrated to the shaft orientations (the direction of passage) (it is drawing 1 (a), (b), (c),



and (d), and the direction of X shows.) divided by the septum, and is constituted. Moreover, the honeycomb member 21 is substantially joined to the direction X of passage of the circulation hole 11 by the joint material 25 of this quality of the material in respect of [ 22 ] being parallel (plane of composition) as substantially as the honeycomb member 21, among this plane of composition 22, the unsealed section 12 is formed including the edge 18 linked to the passage outlet end-face periphery section 15, and the joint material 25 is arranged continuously.

[0078] Here, including a part of part which the unsealed section 12 connects to the passage outlet end face 14 and a side face 13 among planes of composition 22, from the side face 13, the honeycomb structure object 10 shown in drawing 1 (a) is aslant formed so that the width of face of the direction Y of a core of the honeycomb structure object 10 may become small gradually in the passage inlet-port end-face 16 direction. Moreover, although the unsealed section 12 is formed including a part of part which connects with the passage outlet end face 14 and a side face 13 similarly, the configuration of the unsealed section 12 is a rectangle, and the honeycomb structure object 10 shown in drawing 1 (b) is formed from the side face 13 so that the width of face of the direction Y of a core of the honeycomb structure object 10 may become the same in the passage inlet-port end-face 16 direction. Moreover, including the part which the unsealed section 12 connects with the whole part which connects with a side face 13 among planes of composition 22 at the passage outlet end face 14, from the side face 13, the honeycomb structure object 10 shown in drawing 1 (c) is aslant formed so that the width of face of the direction Y of a core of the honeycomb structure object 10 may become small gradually in the passage inlet-port end-face 16 direction. Moreover, including the part which the unsealed section 12 connects to the whole part, the passage outlet end face 14, and the passage inlet-port end face 16 which are connected to a side face 13 among planes of composition 22, from the side face 13, the honeycomb structure object 10 shown in drawing 1 (d) is formed so that the width of face of the direction Y of a core of the honeycomb structure object 10 may become the same in the direction of a passage outlet end face.

[0079] With the honeycomb structure object 10 shown in drawing 1 (a), (b), (c), and (d), even if the ununiformity of temperature distribution like a local elevated temperature or low temperature arises, it can deform freely, without restraining each part of the honeycomb structure object 10 mutually, thermal stress is reduced, and generating of a crack is prevented as much as possible.

[0080] Since the effectiveness of reducing thermal stress by the honeycomb structure object 10 whole especially with the honeycomb structure object 10 shown in drawing 1 (c) and (d) is large, especially in an operating environment by which the ununiformity of temperature attains to the honeycomb structure object 10 whole, it is effective.

[0081] The honeycomb structure object 10 shown in drawing 2 (a) and (b) joins three honeycomb members 21, and is constituted. Like drawing 1 (c), including the part which the unsealed section 12 connects with the whole part which connects with a side face 13 among planes of composition 22 at the passage outlet end face 14, the honeycomb structure object 10 shown in drawing 2 (a) is aslant formed from the side face 13 so that the width of face of the direction Y of a core of the honeycomb structure object 10 may become small gradually in the passage inlet-port end-face 16 direction. Moreover, like drawing 1 (d), including the part which the unsealed section 12 connects to the whole part, the passage outlet end face 14, and the passage inlet-port end face 16 which are connected to a side face 13 among planes of composition 22, from the side face 13, the honeycomb structure object 10 shown in drawing 2 (b) is formed so that the width of face of the direction Y of a core of the honeycomb structure object 10 may become the same in the passage inlet-port end-face 16 direction.

[0082] Also with such a honeycomb structure object, the honeycomb structure object 10 and the same thermal stress reduction effectiveness as abbreviation which are shown in drawing 1 (a), (b), (c), and (d) can be demonstrated.

[0083] Drawing 3 (a) and (b) are the perspective views showing other examples of the honeycomb structure object concerning this invention.

[0084] The honeycomb structure object 10 shown in drawing 3 (a) is established including a part of part which the unsealed section 12 connects to the side face 13 of the honeycomb structure object 10 among planes of composition 22, and all of the parts linked to the passage outlet end face 14. Moreover, in this example, it is prepared so that the unsealed section 12 may connect continuously two points (A, B) of the end-face periphery section 15, and (C, D) and may cross in the center section of the passage outlet end face 14.

[0085] With such a honeycomb structure object 10, it has the advantage that the reduction effectiveness of the thermal stress in the passage outlet end face 14 is large.

[0086] A part of part in which the unsealed section 12 connects further to the side face 13 of the honeycomb structure object 10 the honeycomb structure object 10 shown in drawing 3 (b) among planes of composition 22 It is prepared including all of the parts linked to the passage inlet-port end face 16, and it is prepared so that the end-face periphery section 17 may connect two points (not shown) continuously and the unsealed section 12 may cross in the center section of the passage inlet-port end face 16 like the passage outlet end face 14.

[0087] With such a honeycomb structure object 10, the reduction effectiveness of thermal stress is large at the passage outlet end face 14 and the passage inlet-port end face 16, and generating of a crack can be controlled further.

[0088] As for the honeycomb structure object 10 shown in drawing 4 (a), (b), (c), and (d), the joint material 25 is formed including all the parts that it is arranged in the core of the honeycomb structure object 10, and the unsealed section 12 connects to the side face 13 of the honeycomb structure object 10, the passage outlet end face 14, and the passage inlet-port end face 16 among planes of composition 22. As for drawing 4 (b), drawing 4 (a) shows the case where as for drawing 4 (c) the cross-section configuration of drawing 4 (d) of the joint material 25 is a rhombus when the cross-section configuration of the joint material 25 is a ball-race truck form, respectively, when the cross-section configuration of the joint material 25 is a rectangle, and the cross-section configuration of the joint material 25 is circular.

[0089] With such a honeycomb structure object 10, the reduction effectiveness of thermal stress is very large, and the ununiformity of temperature is large like a local elevated temperature or low temperature, and when the ununiformity is distributed covering the whole honeycomb structure object, it can consider as the honeycomb structure object which does not produce a crack etc.

[0090] On the other hand, the unsealed section 12 is formed including all of the parts which connect with the side face 13 and the passage outlet end face 14 of the honeycomb structure object 10 among planes of composition 22, and a part of part linked to the passage inlet-port end face 16, a part of joint material 25 exposes to the passage inlet-port end face 16 of the honeycomb structure object 10 the honeycomb structure object 10 shown in drawing 5 (a), (b), (c), and (d), and it is prepared.

[0091] Especially with this honeycomb structure object, it has the advantage that the effectiveness of reducing the thermal stress in the passage outlet end face 14 and a side face 13 is large.

[0092] The honeycomb structure object 10 shown in drawing 6 (a), (b), and drawing 7 (a) and (b) Like the honeycomb structure object 10 shown in drawing 4 (a), (b), (c), and (d) The unsealed section 12 is formed including all the parts linked to the side face 13, the passage outlet end face 14, and the passage inlet-port end face 16 of the honeycomb structure object 10 of a plane of composition 22, and many planes of composition 22 are further established by joining and constituting nine honeycomb members 14.

[0093] The honeycomb structure object 10 which the honeycomb structure object 10 shown in drawing 6 (a) and (b) shows the case where the cross-section configuration of the joint material 25 is a rectangle, like drawing 4 (a), and is shown in drawing 7 (a) and (b) shows the case where the cross-section configuration of the joint material 25 is an ellipse form.

[0094] With this honeycomb structure object 10, since the unsealed section 12 can be formed into the honeycomb structure object 10 at a large number and homogeneity in addition to the effectiveness which the honeycomb structure object 10 shown in drawing 4 (a) - (d) described by the way, the thermal stress of the honeycomb structure object 10 can be reduced extremely.

[0095] The honeycomb structure object 10 shown in drawing 8 (a) and (b) Like the honeycomb structure object 10 shown in drawing 4 (a), (b), (c), and (d) Join four honeycomb members 21 by the joint material 25, and the joint material 25 is arranged in the core of the honeycomb structure object 10. The unsealed section 12 is formed including all the parts linked to the side face 13, the passage outlet end face 14, and the passage inlet-port end face 16 of the honeycomb structure object 10 of a plane of composition 22. Moreover, with this honeycomb structure object 10, the restoration member 24 is arranged in a part of unsealed section 12 so that it may expose to the perimeter of the joint material 25 in a part of side face 13. The non-filling section 31 which the restoration member 24 is not arranged but forms the opening is formed including a part of part which connects with a part of side face 13 of the honeycomb structure object 10 among planes of composition 22, and all of the parts linked to the passage outlet end face 14 and the passage inlet-port end face 16.

[0096] With this honeycomb structure object 10, since the non-filling section 31 is formed in all of the parts linked to the passage outlet end face 14 and the passage inlet-port end face 16 while a fluid cannot flow the unsealed section 12 in the direction of passage and can prevent the blow by of a fluid by existence of the restoration member 24, it has the advantage that the reduction effectiveness of thermal stress is very large.

[0097] Honeycomb structure object 10 shown in drawing 9 (a) and (b) Everything but establishing many planes of composition 22 is taken as the same configuration as the honeycomb structure object 10 shown in drawing 8 (a) and (b) by joining and constituting nine honeycomb members 14 like the honeycomb structure object 10 shown in drawing 6 (a) and (b).

[0098] With this honeycomb structure object 10, since the unsealed section 12 can be formed into the honeycomb structure object 10 at a large number and homogeneity in addition to the effectiveness which the honeycomb structure object 10 shown in drawing 8 (a) and (b) described by the way, the thermal stress of the honeycomb structure object 10 can be reduced extremely.

[0099] Drawing 10 (a), (b), and (c) show the operation gestalt in the case of using as a honeycomb filter. In the honeycomb filter 1 shown in drawing 10 (a), (b), and (c) Like the honeycomb structure object 10 shown in drawing 4 (a), (b), (c), and (d) Four honeycomb filter members 33 are joined by the joint material 25. The joint material 25 is arranged in the core of a honeycomb filter 1, and the unsealed section 12 is formed including all the parts linked to the side face 13, the passage outlet end face 14, and the passage inlet-port end face 16 of a honeycomb filter 1 of a plane of composition 22. Moreover, it exposes between the restoration member 24 which is arranged in a part of unsealed section 12 so that all the parts from which the opening formed of the unsealed section 12 exposes the restoration member 24 to the passage inlet-port end face 16 in this honeycomb filter 1 may be blockaded, and was arranged in the passage inlet-port end-face 16 side, and the joint material 25, and to the passage outlet end face 14, and the non-filling section 31 which a filler is not arranged but forms the opening is formed.

[0100] In this honeycomb filter 1, since the opening is formed near the passage outlet end face 14 and the passage inlet-port end face 16, without the soot in exhaust gas accumulating on the non-filling section 31 by the side of a gas inflow while being able to use suitably as a honeycomb filter, it has the advantage that the reduction effectiveness of thermal stress is very large.

[0101] Next, although the example of the manufacture approach of of the honeycomb structure object and honeycomb filter concerning this invention is explained, this invention is not limited to these.

[0102] (Example 1 of manufacture) As a raw material, the mixed powder of 75 % of the weight of SiC powder and 25 % of the weight of metal Si powder was used, methyl cellulose and hydroxypropoxyl methyl cellulose, a surfactant, and water were added to this, and the reversible plastic matter was produced.

[0103] Subsequently, extrusion molding of this plastic matter is carried out, it has the configuration from which the cross-section configurations of shaft orientations and a perpendicular direction which cut the shape of a cylindrical shape comparatively at fixed spacing to shaft orientations for 9 minutes, and are acquired differ [ rectangular head / a sector ], respectively, and 0.3mm and a cel consistency produced [ the thickness of a septum ] two or more honeycomb objects of 31 cels / cm<sup>2</sup>.

[0104] Subsequently, it dried, after assembling to one by forming the junctional zone of the presentation same into the abbreviation central part of an parallel field as a plastic matter substantially after desiccation by microwave and hot blast with the direction of passage of a circulation hole [ in / for the honeycomb object of these plurality / a honeycomb object ], and joining each of this honeycomb object through this junctional zone after that. It degreased at about 400 degrees C among N<sub>2</sub> ambient atmosphere, and the desiccation object after the acquired assembly was calcinated at about 1550 degrees C in inert atmospheres, such as Ar, after that. The dimension was able to produce the honeycomb structure object shown in 144mmphix152mmL and drawing 9 whose clearance between joints is 2mm by filling up width of face of 5-10mm with the filler which contains for example, the nature fiber of aluminosilicate, SiC powder, metal Si complications, an organic binder, an inorganic binder, and water in the periphery section of the unsealed section after baking, and drying at about 100 degrees C.

[0105] In the example 1 of manufacture, fabricate the honeycomb object of the prism configuration whose end-face configuration is 50mmx50mm, and after joining two or more honeycomb objects and unifying, calcinate and the appearance of the acquired honeycomb structure object is processed. (Example 2 of manufacture) The dimension was able to produce the honeycomb structure object shown

in drawing 9 like the example 1 of manufacture except having produced the honeycomb structure object having considered as the shape of a cylindrical shape of 144mmphix152mmL, and by applying a periphery and subsequently, calcinating the same plastic matter as a junctional zone.

[0106] Like the example 1 of manufacture, fabricate the honeycomb object of the prism configuration whose end-face configuration is 50mmx50mm, and after joining two or more honeycomb objects and unifying, calcinate and the appearance of the acquired honeycomb structure object is processed.

(Example 3 of manufacture) Subsequently the dimension was able to produce the honeycomb structure object shown in drawing 9 like the example 1 of manufacture except having produced the honeycomb structure object having considered as the shape of a cylindrical shape of 144mmphix152mmL, and by applying a periphery and drying with a filler.

[0107] (Example 4 of manufacture) The honeycomb filter was able to be manufactured by the same above-mentioned approach as the examples 1-3 of manufacture except performing the process which \*\*\*\*\* the both-ends side of honeycomb member passage alternately.

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## EXAMPLE

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[Example] Hereafter, although this invention is further explained to a detail based on a concrete example, this invention is not limited to these examples.

[0109] By the example 1 of example 1 manufacture, the dimension produced the diesel-power-plant exhaust air purification party curate honeycomb filter which \*\*\*\*\* (ed) alternately 144mmphix152mmL and the circulation hole of a large number which 0.3mm and a cel consistency penetrate [ the thickness of a septum ] to the passage inlet-port end face and passage outlet end face of the honeycomb object made from SiC of 31 cels / cm<sup>2</sup> by the passage inlet-port end face and passage outlet end face which a circulation hole penetrates. Moreover, in this honeycomb filter, as shown in drawing 1 (a), a part of part which connects the unsealed section 12 to the passage outlet end face (upper limit side) 14 and a side face 13 among planes of composition 22 is included. From the side face 13, it has prepared aslant so that the width of face of the direction Y of a core of the honeycomb structure object 10 may become small gradually in the passage inlet-port end-face 16 direction. The die length of the unsealed section 12 was set to 50mm in the direction of passage of the honeycomb structure object 10 in the direction of a core of 30mm and the passage outlet end-face (upper limit side) periphery section 15 to the honeycomb structure object 10 from the passage outlet end-face (upper limit side) periphery section 15.

[0110] In examples 2-6 and ten examples 1, respectively Drawing 1 (d), drawing 3 (a), having considered as the structure of having drawing 3 (b), drawing 4 (a), drawing 4 (b), and the unsealed section shown in drawing 7 -- and When the opening formed between the unsealed sections 12 of the honeycomb structure object 10 was exposed and formed in the passage inlet-port end face (lower limit side) 16, the same thing as an example 1 was produced except having arranged the restoration member 25 of the property which shows the part to expose in Table 1 so that it may blockade in a depth of 6mm.

[0111] In addition, a Young's modulus ratio is a ratio of the Young's modulus of a filler to the Young's modulus of a honeycomb member among Table 1, and measurement calculation was carried out from the relation between a load and the amount of displacement by the static-modulus examining method about each Young's modulus. Moreover, reinforcement meant the material strength of the filler to a honeycomb member, and it measured by the four-point bending test (JIS1601) using the material testing machine about each material strength. Moreover, the case where the direction of a filler had large reinforcement was indicated to be "size", and the case of being small was indicated to be "smallness."

[0112] In seven to example 9 example 6, the same thing as an example 6 was produced except having used the thing of the Young's modulus ratio which shows a filler in Table 1, and reinforcement.

[0113] In example 11 example 1, the same thing as an example 1 was produced except having formed the unsealed section 12 by die length of 5mm in the direction of passage of die length of 15mm, and the passage outlet end-face (upper limit side) periphery section 15 to the honeycomb structure object 10 in the direction of a core of the passage outlet end-face (upper limit side) periphery section 15 to the honeycomb structure object 10.

[0114] While making it the structure shown in drawing 3 (a) in an example 12 and 13 examples 1 The same thing as an example 1 was produced except the established thing which formed the unsealed section

12 by die length of 15 or 5mm in the direction of a core of die length of 15 or 5mm, and the upper limit side periphery section 15 to the honeycomb structure object 10 in the direction of passage of the upper limit side periphery section 15 to the honeycomb structure object 10, respectively.

[0115] The same thing as an example 1 was created except having created the thing of integral construction which does not have the example of comparison 1 unsealed section.

[0116] The mat non-expanded made from a ceramic is wound around the side face 13 of the honeycomb structure object (honeycomb filter) 10 as grasping material. (Evaluation) After pushing into the can for cannings made from SUS409 and considering as the canning structure, By making the combustion gas containing the soot generated by combustion of diesel fuel gas oil flow from the lower limit side 16 of the honeycomb structure object (honeycomb filter) 10, and making it flow out from the upper limit side 14 Once carrying out uptake of the soot into the honeycomb structure object (honeycomb filter) 10 and then cooling radiationally to a room temperature, By making the combustion gas which contains the oxygen of a fixed rate at 800 degrees C from the lower limit side 16 of the honeycomb structure object (honeycomb filter) 10 flow, the filter playback trial which carries out combustion removal of the soot was carried out.

[0117] In the honeycomb filter of examples 1-10 and the example 1 of a comparison the transition duration which raises inlet gas temperature from a room temperature to 800 degrees C, and uptake soot weight -- three kinds (transition duration: -- standard conditions (300 seconds) --) the \*\* (240 seconds) shortest (180 seconds) (uptake soot weight: -- standard conditions (10g/L) --) Size (14g/L) and when examining by carrying out the maximum (18 g/L) setup, the existence of generating of the crack in each part of the upper limit side (outlet) of a honeycomb structure object, a lower limit side (inlet port), a periphery, and the interior was investigated.

[0118] On the other hand, in the honeycomb filter of examples 1, 11-13, uptake soot weight was quantitatively set up by six kinds of 10 g/L - 20 g/L (transition duration: standard conditions), and the filter playback trial was carried out like \*\*\*\*. A result is collectively shown in Tables 1 and 2. In addition, about generating of a crack, O showed what was not generated at all and \*\* showed what was generated.

[0119]

[Table 1]

	構造	捕集すす量		最大				大				標準			
		過渡時間		最短				短				標準			
		クラック調査部位		入口	出口	内部	外周	入口	出口	内部	外周	入口	出口	内部	外周
		充填材	ヤング率比	強度											
実施例1	図1(a)	80%	小	△	△	△	△	△	○	○	△	○	○	○	○
実施例2	図1(d)	80%	小	△	△	△	△	○	○	○	○	○	○	○	○
実施例3	図3(a)	80%	小	△	○	△	△	△	○	○	△	△	○	○	○
実施例4	図3(b)	80%	小	○	○	△	△	○	○	△	△	○	○	○	○
実施例5	図4(a)	80%	小	○	○	△	△	○	○	○	○	○	○	○	○
実施例6	図4(b)	80%	小	○	○	○	△	○	○	○	○	○	○	○	○
実施例7	図4(b)	83%	小	○	○	△	△	○	○	○	△	○	○	○	○
実施例8	図4(b)	80%	大	○	○	△	△	○	○	△	△	○	○	○	○
実施例9	図4(b)	85%	大	○	△	△	△	○	○	△	△	○	○	○	○
実施例10	図7	80%	小	○	○	○	○	○	○	○	○	○	○	○	○
比較例1	未接合部無し	80%	小	△	△	△	△	△	△	△	△	△	△	○	○

[0120]

[Table 2]

		実施例1	実施例11	実施例12	実施例13
構造	未接合部	図1(a)	図1(a)	図3(a)	図3(a)
	中心方向長さ	50mm	15mm	15mm	5mm
ハニカム構造体	流路方向長さ	30mm	5mm	15mm	5mm
	直径	144mm	144mm	144mm	144mm
捕集すす量 (g/L)	全長	152mm	152mm	152mm	152mm
	10	○	○	○	○
	12	○	○	○	△
	14	○	△	○	△
	16	○	△	○	△
	18	○	△	○	△
	20	○	△	△	△

[0121] As shown in Table 1, even if it was the case of standard conditions, in the honeycomb structure

object of the example 1 of a comparison of unsealed-section-less structure, there was no generating of a crack at the honeycomb filter ( drawing 1 (a), drawing 1 (d), drawing 3 (a), drawing 3 (b), drawing 4 (a), drawing 4 (b), drawing 7 ) of examples 1-10 to generating of a crack being accepted in the end face of an inlet port and an outlet.

[0122] In addition, although generating of a crack might arise in part when a transition duration is shortened, uptake soot weight was made to increase, the ununiformity of temperature became large and the unsealed section was formed only near the end side of the periphery section of a honeycomb filter like drawing 1 (a) and drawing 3 (a) The side face of a honeycomb filter [ in / like drawing 4 (b) / in the unsealed section / a plane of composition ], In the honeycomb filter prepared including all the parts linked to a passage outlet end face and a passage inlet-port end face, a crack was hardly generated, and generating of a crack was not accepted at all in the example which increased the number of planes of composition further like drawing 7 . Moreover, the Young's modulus of a filler was 80% or less of the Young's modulus of a honeycomb member, or when the material strength of a filler was smaller than the honeycomb member, there was little generating of a crack.

[0123] Moreover, as shown in Table 2, the inclination for the rate which a crack will generate according to increase of the amount of soot if the direction of passage of the upper limit side periphery section 15 to the honeycomb structure object 10 of an unsealed part and main lay length become shorter than predetermined to increase was accepted.

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## DESCRIPTION OF DRAWINGS

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### [Brief Description of the Drawings]

[Drawing 1] It is the perspective view showing the various examples of the honeycomb structure object concerning this invention.

[Drawing 2] It is the perspective view showing each of other example of the honeycomb structure object concerning this invention.

[Drawing 3] It is the perspective view showing each of other example of the honeycomb structure object concerning this invention.

[Drawing 4] It is the perspective view showing each example of further others of the honeycomb structure object concerning this invention.

[Drawing 5] It is the perspective view showing each still more nearly another example of the honeycomb structure object concerning this invention.

[Drawing 6] Still more nearly another example of the honeycomb structure object concerning this invention is shown, (a) is a perspective view and (b) is the Y-Y cross-section explanatory view of (a).

[Drawing 7] Still more nearly another example of the honeycomb structure object concerning this invention is shown, (a) is a perspective view and (b) is the Z-Z cross-section explanatory view of (a).

[Drawing 8] Still more nearly another example of the honeycomb structure object concerning this invention is shown, (a) is a side elevation and (b) is the A-A cross-section explanatory view of (a).

[Drawing 9] Still more nearly another example of the honeycomb structure object concerning this invention is shown, (a) is a side elevation and (b) is the B-B cross-section explanatory view of (a).

[Drawing 10] One example of the honeycomb filter concerning this invention is shown, and (a) is [ a top view and (c of a side elevation and (b)) ] bottom views.

[Drawing 11] The example of arrangement of the slit of the honeycomb structure object concerning this invention is shown, and, for (a), a top view and (b) are [ a side elevation and (d of a front view and (c)) ] bottom views.

### [Description of Notations]

1 -- A honeycomb filter, 10 -- A honeycomb structure object, 11 -- Circulation hole (through tube), 12 -- The unsealed section, 13 -- The side face of a honeycomb structure object (honeycomb filter), 14 -- A passage outlet end face (upper limit side), 15 -- The end-face periphery section, 16 -- Passage inlet-port end face (lower limit side), 17 [ -- A septum, 21 / -- A honeycomb member, 22 / -- A plane of composition, 24 / -- A restoration member, 25 / -- Joint material, 31 / -- The non-filling section, 32 -- \*\*\*\* member, 33 / -- Honeycomb filter member. ] -- The end-face periphery section, 18 -- The edge, 19 linked to the passage outlet end-face periphery section -- The edge, 20 linked to the passage inlet-port

end-face periphery section